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HEATING AND VENTILATING

COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL AIR CONDITIONING, REFRIGERATION, PIPING, HEATING, VENTILATION

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HEATING AND VENTILATING

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NEXT MONTH'S ISSUE

Two approaches to fuel conservation will be presented next month —one that will result in fuel saving in industrial plants and the other on controlling the use of fuel in homes. The article in the series on Process Piping in Industrial Plants will cover piping of petroleum and petroleum products.

Steel takes the Backache out of Monday

THIS is Monday in Europe. Even after the war, this age-old routine, familiar to every Continental village, must continue. Steel is too scarce and too expensive over there for most people to enjoy the household facilities that we take so much for granted.

Plentiful, low-cost steel relieves American women of drudgery--makes available to the masses the "luxuries" of running water, automatic laundry equipment, refrigerators, ranges. There is no other metal sufficiently abundant or suitable to take over this job.

For 42 years, Youngstown has helped to convert America into a nation of running water--supplying millions of miles of durable, low-cost steel pipe, fabricated by constantly improved, more efficient methods. Youngstown has also supplied steel sheets for millions of washers and tubs, ranges, refrigerators and other home equipment.

Now, war's demands for steel are being satisfied. But soon we shall resume the unfinished job of supplying you, our customers old and new, with dependable, economical pipe and sheets to further eliminate drudgery and advance the American standard of living.

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Based on Experience

Practical Information Regarding Moisture Variations, Construction Variations and Roof Sprays as Applied to Air Conditioning

E. L. SCHULZ

Engineer, Carrier Corp., Syracuse, N. Y.

This article, part of a series, is based upon experiences in the air conditioning field accumulated in recent years by several companies, and by technical men in various parts of the country. Since it is not a record of one man or one company, the findings have much more than usual significance.

SINCE each day is apt to bring forth a new application of air conditioning and refrigeration that is interesting, or some phase of installation that is novel, a compilation of experiences should be of interest to others in this field. This dissemination of information should be of indirect value to speed wartime production and increase industrial efficiency.

Success on any installation depends upon good work by the design engineer, the construction department, and the operating and maintenance men. Although the various case histories and experiences are presented for these three groups, the information may also be of value to the owner, and potential buyer. Each will be in a better position to select equipment and to operate a system.

The experiences and incidents are grouped around certain well defined subjects of the field and several of these divisions will be covered in each installment of this series.

Moisture Penetration

Much has been written within the past two years, on moisture penetration, particularly as it applies to moisture condensation within building walls during the winter season. While condensation primarily concerns the heating system, the results may seriously impair the operation of the air conditioning system during the summer months. Heat transmission

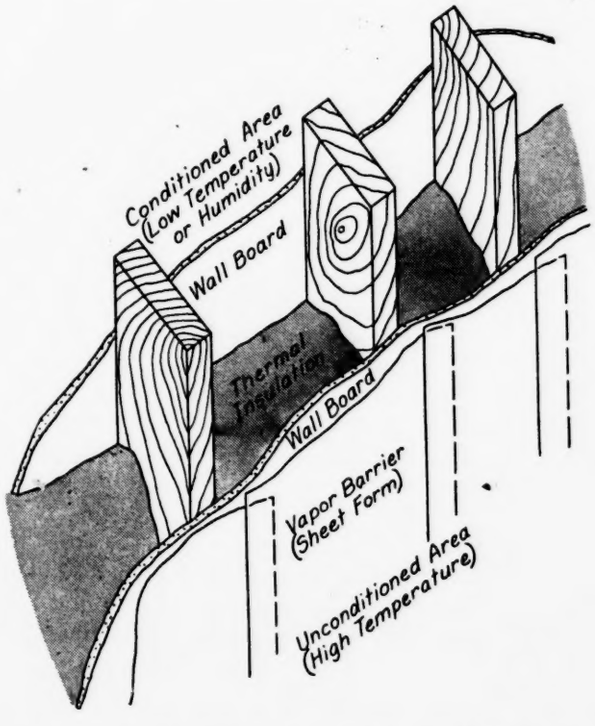


Fig. 1. Correct method of applying vapor insulation—applied to wall on unconditioned area side. Note the generous overlap of vapor barrier sheets to eliminate possible cracks or open seams.

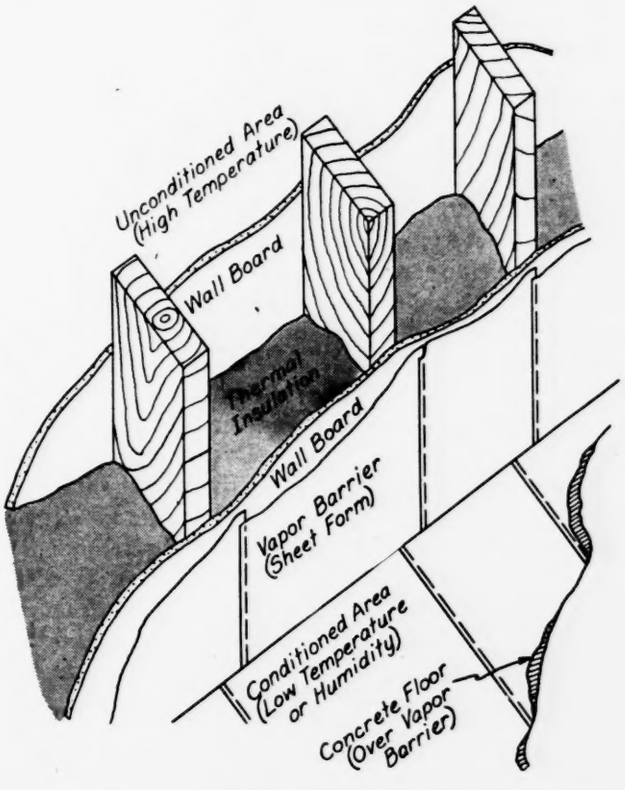


Fig. 2. Wrong method of applying vapor insulation—applied to wall on conditioned area side. Overlap of vapor barrier is insufficient to prevent moisture penetration at seams after the building has "weathered."

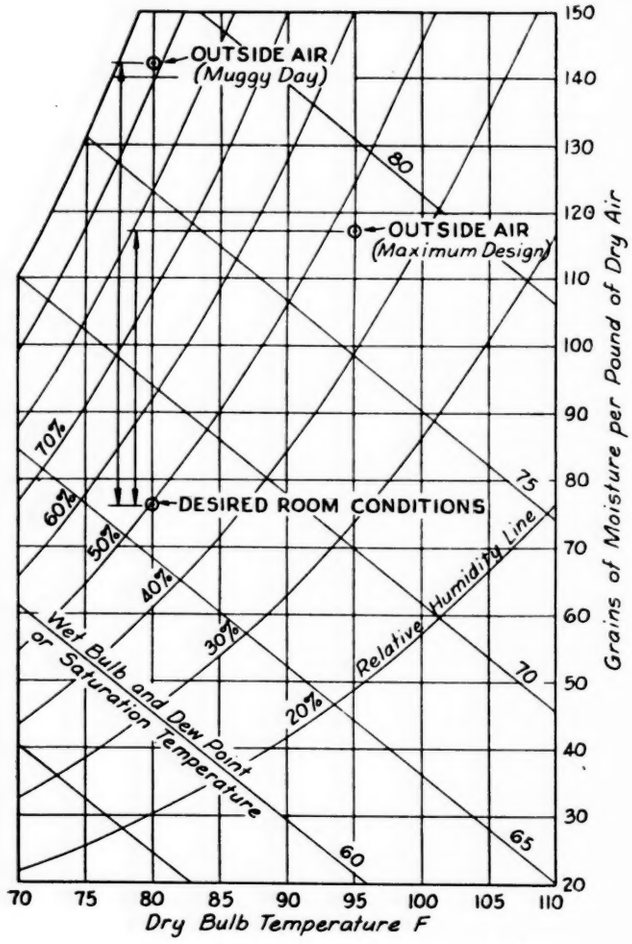


Fig. 3. Psychrometric chart on which are superimposed lines showing the difference in vapor pressures for different types of outdoor days.

through the walls is influenced by dry rot. With the exception of a few low humidity or low temperature applications, dry rot is a result of winter operation.

Unfortunately, with few exceptions, it is a general rule that the better the installation for heat (thermal), the poorer its ability to resist moisture penetration. Most fibrous insulations, known for their excellent thermal insulation characteristics, are of little or no value as vapor insulation without the addition of suitable moisture barriers. Even brick, concrete, and wood are poor moisture insulations without the addition of a suitable vapor barrier. In general, oil-based paint, which would seem to present good barrier characteristics, actually proves to be poor.

The question may be asked: How is it that we have been able to get by with so many air conditioning installations for a number of years without running into trouble from moisture penetration? There are several answers.

It is possible a trouble job was analyzed as having insufficient capacity. Another provided excellent dry bulb temperature control with poor or inadequate control of relative humidity, and was analyzed as faulty controls. Both of these examples might well have been due to moisture penetration.

The part that moisture penetration can play can best be demonstrated by a glance at a psychrometric chart and vapor pressure tables. Consider an installation designed to maintain room conditions of 80F dry bulb and 50% relative humidity when outside air conditions are 95F dry bulb and 78F wet bulb. This installation is located in an area where the sun load and sensible heat transmission loads are relatively low.

Fig. 3, illustrating these two points on the psychrometric chart, shows that the vapor pressure difference is .267 in. of mercury which is equivalent to a moisture difference of 41 grams per pound of dry air. In fact, the average building wall is sufficient to prevent any appreciable moisture penetration from outside, and the equipment installed will undoubtedly maintain design room conditions.

Now, suppose this same installation operates on a humid or "muggy" day when outside air conditions have changed to 80F dry bulb and 78F wet bulb. The wet bulb temperature has not changed. The total heat of the outside air is the same as the original design conditions. Consequently it is the usual assumption of the design engineer that the total refrigeration load is equal to, or is less than the maximum design of 95F dry bulb and 78F wet bulb.

Referring again to the data on vapor pressure, it is found that the pressure difference between outside and inside has almost doubled.

This now means a vapor pressure difference of 0.429 in. of mercury, or 66 grains per pound of dry air. The vapor pressure difference has become of sufficient magnitude to cause a rapid transmission of water vappor through the building from the outside to the conditioned space. We have a system which seems to maintain satisfactory room dry bulb conditions, but the relative humidity or wet bulb temperature exceeds the desired level. All too often, this is blamed on the control when, in reality, it is due to insufficient latent heat capacity.

Another difficulty is sometimes encountered on the job which calls for maintaining low relative humidities. As an example, the previous outside design conditions is taken of 95F dry bulb and 78F wet bulb with room conditions to be maintained at 80F dry bulb and 20% relative humidity. Referring again to the vapor pressure tables, it is evident that the pressure difference is many times greater than that of the average "comfort" job. The vapor pressure difference between the outside and the conditioned space is now 0.576 in. of mercury.

Unless suitable recognition is given to the moisture penetration in calculating the latent heat load, this job is almost certain to show inadequate capacity. Of course, conditions will be even more exaggerated on the "muggy" day for the vapor pressure differential is increased. If the heat transmission load due to sun radiation is small at maximum load conditions, the apparatus is almost certain to suffer under such a doubling-up effect. When that "muggy" day comes along, not only must the refrigeration compressor

run at full load to handle the calculated maximum load, but it is also called upon to handle, if possible, a greatly increased uncalçulated load due to moisture penetration.

Similarly, applications involving low temperatures such as cold storage rooms and chilling rooms usually carry a large vapor pressure differential across the walls of the room. These rooms are generally constructed with some form of bitumastic coating for a vapor or moisture barrier but often the barrier is supplied with little appreciation of the problem involved.

Five or six years ago, I was associated with several extremely low relative humidity jobs, involving relative humidities approximating 10%. All jobs functioned well, except on humid or muggy days, when it was impossible to maintain the designed relative humidity conditions. Tests on each job revealed that the latent heat load was larger than ordinarily encountered, and in one case, was almost 40% greater than the load calculated by the known sensible heat factors.

It is evident that the load increase in each case was due to moisture infiltration. No one had attempted to evaluate such a type of load as latent heat transmission although there had been attempts to apply a protective safety factor to the room latent heat load.

With the meagre data available, a set of values was established to permit calculation of the amount of moisture infiltration through average building materials. Since that time these values have been used consistently at least by one company on all low humidity jobs, and no further trouble has been encountered.

Within the last year several periodicals have carried rather complete tabulations for the amount of moisture penetration through various building materials. A word of caution should be extended on applying these values as published. With no thought of detracting from the value or importance of these publications a safety factor of as much as 100% should be used in calculating loads from these values. This recommendation is based on a comparison of laboratory and field conditions. Most building materials tend to change their characteristics after weathering for several years. This is due to the tendency of some materials to dry and crack, and in other cases to settle. Then, too, there are variations in building construction that form an important contingency upon the acceptance of these values.

Construction Variations

A problem of apparent reduction in capacity of an air conditioning apparatus occurred a few years ago. However, tests indicated that the equipment was performing in excess of load calculations. Investigation disclosed that the building was located in an area where there was considerable blasting underground. While dynamiting was not discernible to building occupants, it was certainly felt by the

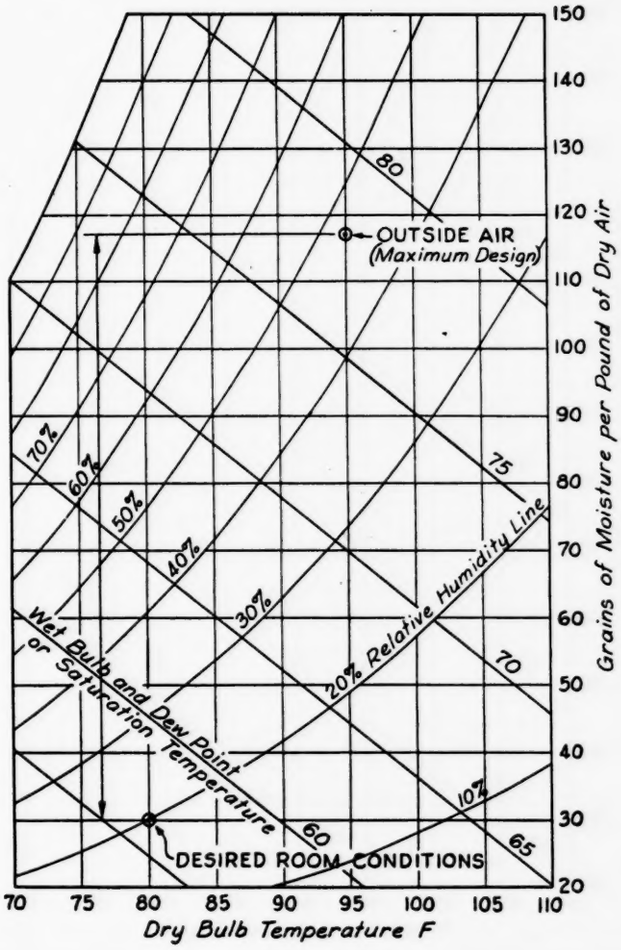


Fig. 4. Psychrometric chart on which lines have been superimposed to illustrate points discussed in the article.

building itself. Almost every seam in the building had been opened by the repeated shock, resulting in a tremendous amount of infiltration.

After practically rebuilding the structure, it was possible to reduce the infiltration load to a value which was consistent with the average type of building. Once again the total load on the system was within the capacity of the installed apparatus and it was possible to maintain design conditions within the space. This example presents rather an extreme, but is significant because it demonstrates the effects of cracks in a building upon the ability of the air conditioning apparatus to perform its normal duties.

Another example concerns a metal fabricated housing exposed to the sun. The building was assembled with extreme care. All seams were well caulked to prevent leakage. After a few years the continual cooling and heating from temperature differences between day and night resulted in premature aging of the building. The continuous expansion and contraction worked loose all caulking. As in the previous case, the infiltration figures had become so large that it was impossible to maintain the design contions within the space.

This is also an extreme example. However, both of the experiences indicate the importance of aging

Fig. 5. Roof sprays and cooling pond on a roof.

or cracking of building structures. Leakage should be put on a check list for investigation the next time a job shows up with an apparent loss in capacity after a two- or three-year period of satisfactory operation. It should also point out the desirability of increasing the design safety factor on heat transmission loads where a poorly constructed building is to be conditioned.

Roof Sprays

Roof sprays, or flooded roofs, are advantageous for reducing the amount of roof heat transmission due to sun effect. The use of such sprays has proved their worth, almost universally, but such use has also been the source of many small complaints.

For those who have not yet utilized this means of reducing heat transmission factors due to solar radiation, it is most desirable to caution the customer about the effects of this water concentration on normal roofing surfaces. This caution should be particularly stressed in all preliminary contract negotiations as well as in writing the formal contract.

As an example, a customer had readily accepted the idea of utilizing roof sprays to reduce the air conditioning load. During the discussion, the condition of the roof had been mentioned several times. In every case, the customer had said that the building roof was in excellent condition and would not leak.

The spray system was installed and operated intermittently. However, the alternate wetting and drying of the roof cracked the roof surfaces. Soon complaints were registered about water seepage through the walls and ceiling.

While it is true that the contractor can protect himself by including a clause in his contract which would relieve him of all responsibility for roof seepage, on the other hand, attempts to provide contract protection for all contingencies cannot be condoned. Either the contractor fixes up the building at his own expense or loses a good customer.

This condition can readily be averted if the contractor insists on additional protection against water by means of properly preparing the existing roof and insisting on extra roof maintenance. Most leakage is not caused by continuous wetting of the roof surfaces, but rather by the alternate wetting and drying. If it is possible to keep the roof continuously flooded throughout the summer operating period, there will be less chance for leaks.

Storing Sub-bituminous Coal

Although the storage of sub-bituminous coal in houses usually is not recommended because of the possibilities of deterioration and spontaneous combustion, Bureau of Mines engineers have shown how this type of coal can be stored for at least 8 months in an ordinary residence bin and still produce better-than-average results in a hand-fired furnace used in residences.

In a test at the Bureau, 10 tons of sub-bituminous lump coal were placed in storage. The larger lumps of coal were thrown into the bin by the delivery man, and the smaller pieces were dumped from the wheelbarrow. The coal in the bin was kept as level as possible during the period of delivery, and the fines resulting from breakage, which collected under the delivery window, were distributed, as far as practical, throughout the pile. This operation required about 45 minutes. After the first 5 tons had been placed in the bin, the pile was leveled and some of the smaller lumps were packed into the voids in the corners and along the sides of the bin. The same process was repeated with the second 5 tons. After all of the coal was in the bin and leveled, it was covered with wrapping paper weighted down with a few lumps of coal. The coal pile in the bin was about 4½ feet high. The clearance space under the door was closed with rags to prevent circulation of air.

No significant physical or chemical changes were observed after 8 months. The stored coal was burned in a hand-fired furnace with higher heating efficiencies than the average home fireman obtains in using coking coal, a fuel of higher rank. All tests were conducted under normal conditions in a typical 6-room modern brick home, and heating efficiencies of 65 to 69% were reached.

The Bureau's report on the study, prepared by V. F. Parry, senior fuel technologist, and W. S. Landers, associate chemical engineer, presents detailed data on changes in the physical and chemical properties of the coal, temperatures of the coal pile and the outside air, performance of the furnace, and the temperature and composition of the stack gases. The tests are discussed in the publication Report of Investigation 3759, "Domestic Storage of Sub-bituminous Lump Coal and Its Performance in a Hand-fired Furnace."

Farewell to Snow Shoveling

T. NAPIER ADLAM
Vice-President, Sarco Company, New York, N. Y.

Radiant heat system extended to include concrete walk. Snows and frosts of last winter were easily removed.

SINCE our employees have to walk out of doors some distance from the main plant to the cafeteria, and as it was not desirable to erect a covered walk-way, I decided to form a concrete footpath with heating pipes below.

The cafeteria, which was erected two years ago,

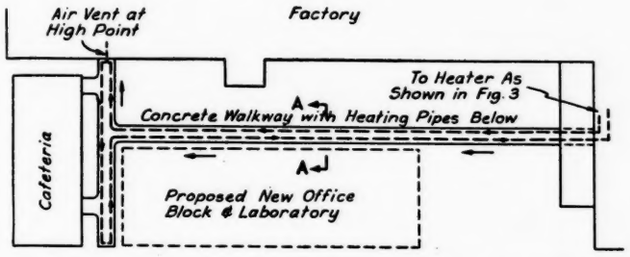


Fig. 1. Outline of footpath from the main building to the cafeteria.

has pipe coils embedded in the plaster of the ceiling and also in the concrete floor. Both floor and ceiling surfaces are utilized for radiant heat in the winter and the ceiling is used for radiant cooling in the summer. Results of this combination proved to be very successful, but owing to the inroads made by war work, the research work contemplated in connection with cooling has been somewhat delayed.

The outline of the footpath from the main building to the cafeteria is shown in Fig. 1 and the dotted lines indicate the position of the pipes under the concrete slabs. Fig. 2 is a cross-section of the footpath showing how the pipes are embedded in the broken stone below the concrete.

After the trench was formed, a layer of cinders 3 in. thick was laid on the earth and then a layer of broken stone to a depth of 5 in. The 1 1/4 in. wrought iron pipes were placed on the broken stone and given a gradient of 1/32 in. per foot run in the direction of arrow, Fig. 1. Concrete was then poured on the top, forming slab 4 x 6 ft and 4 in. thick.

Since heat is only required for melting snow which falls on the footpath, or to prevent the formation of ice during a freezing rain storm, it was first intended to use steam as a heating medium. However, owing to the fact that on our first trial the condensate froze before it reached the extreme end of the line, it was finally decided to use hot water as the heating medium with an anti-freeze solution added.

Although the system has withstood very severe frosts, it has not been possible to test the efficacy of this installation with heavy snow, since very little

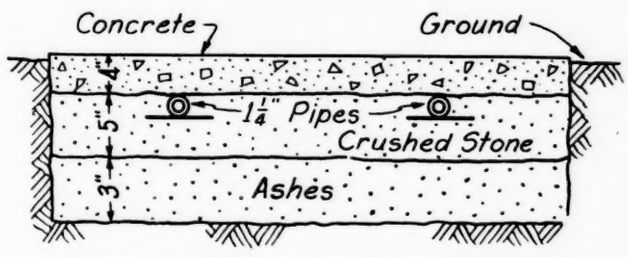


Fig. 2. How pipe is embedded below the walk.

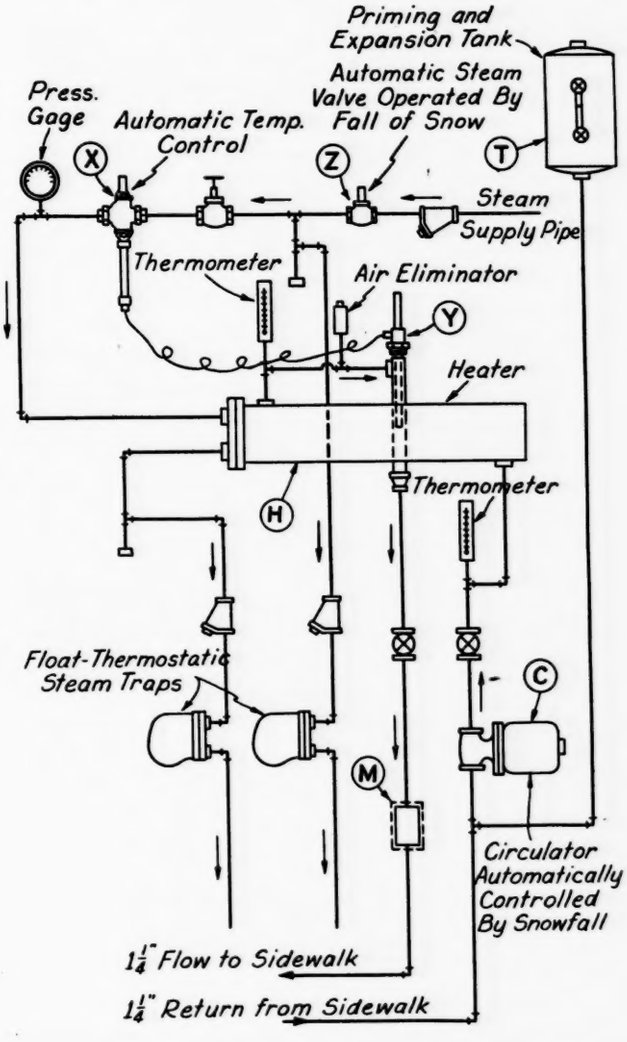


Fig. 3. Hookup for heater and circulator.

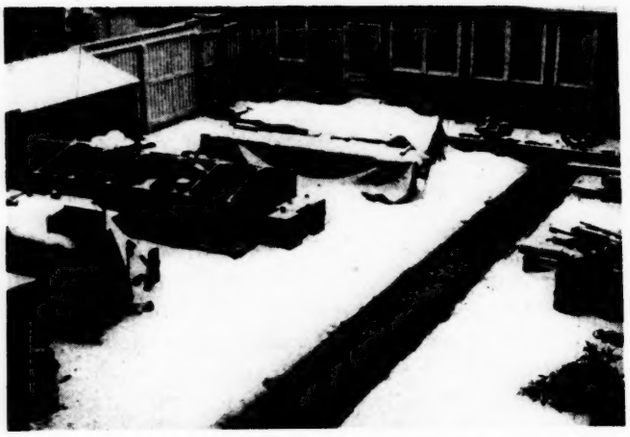


Fig. 4. How heated walk melted the snow.

snow was encountered last winter and only one storm of a few inches snow occurred after the footpath was ready for use. The rapidity with which the snow melted when the heat was turned on, however, gives great promise for its value in keeping footpaths free of snow and ice. I hope it will be possible to give this a more severe test next winter and also to try out the automatic feature for turning on the heat when snow falls. This automatic feature consists of a metal plate which operates an electric device for starting the circulator and turning on the heat when snow or ice adds weight to the sensitive suspended plate.

Fig. 3 illustrates the hookup of heater and circulator with a filling tank for adding anti-freeze. This is more elaborate than is actually necessary, but the author is anxious to measure the heat used in such an installation and to try out the advisability of automatic control.

This same principle can be applied to gas stations and similar spaces where it is desirable to save time and labor in keeping the drive-way clear of snow. It can also be applied, on a much larger scale, to the runways of airports. Rapid melting of snow on runways at airports would not only expedite the taking off and landing of planes, but the actual landing of the planes would be made very much safer because the dark runways will show up clearly against the surrounding snow-covered ground.

Within the next few months, a fairly large office block and laboratory may be erected. Radiant heating and cooling surfaces will be installed in all the offices and provision will be made for air conditioning, as found desirable, to work in conjunction with the cool ceiling panels. I believe it is generally conceded that the usual method of providing very cold air in connection with air conditioning is disagreeable to many and often causes nausea and other ill effects. Abrupt changes in temperature, experienced when going from one building to another or from the outside, cause a mild shock to the body.

The laboratory will be equipped with a complete set of instruments, recently purchased or made in our own plant, to obtain reliable data on surface efficiencies and on the actual comfort conditions in this country as compared with those established in other countries. Records will be made and tabulated as to the prolonged result of these conditions on the occupants of the offices in this same building.

Engineering Control Necessary for Air in Neoprene Plants

War workers have been assured that use of synthetic rubber in making tires, self-sealing gas tanks, de-icers, barrage balloons, life-boats and a thousand other tools of war need not impair their health and efficiency, given modern engineering control of gases, vapors and dusts. The assurance came from the United States Department of Labor in a pamphlet entitled *Neoprene,* the first of several reports on a year's study of health hazards in this wartime industry.

At the request of the Rubber Products Branch of the War Production Board, Secretary Perkins said Labor Department technicians had investigated every phase of workers' exposure to possibly harmful chemicals in the production, processing and fabricating of synthetic rubbers. Initiated at a conference in Akron, Ohio, in which management and organized labor participated, the survey indicated that:

(1) In handling basic raw material used in the manufacture of synthetic rubbers, relatively few workers experience danger, and this primarily in the event enclosed operations break down;

(2) A much larger number of persons engaged in processing and fabricating operations are exposed to possible hazards;

(3) The provision of engineering control of gases, vapors, irritating dusts and excessive heat is modern industry's answer to the prevention of such hazards. These controls, under qualified engineering and medical supervision, are achieving a steady reduction in the discomfort and illness experienced in certain departments before satisfactory protection was provided; and

(4) Few materials unfamiliar to the natural rubber industry are involved and these are receiving intensive study.

These reports are being issued because there are war contractors and sub-contractors not yet fully familiar with the engineering precautions called for to protect workers' health during the fabrication of synthetic rubbers. Bulletin No. 1 deals with neoprene because it was the first commercially successful synthetic rubber. The publication also describes the Government's rubber program in general and serves as an introduction to future bulletins.

Heating and Ventilating Fires in War Plants

H. P. QUADLAND
Safety Research Institute, New York, N. Y.

FIRES, of significance to the heating and ventilating field, have caused many interruptions to production during the war. These fires offer object lessons from a fire prevention viewpoint and encourage fire protection measures.

Study of important fires related to heating and ventilating in war plants from December 7, 1941 to March 7, 1944, as reported by the National Fire Protection Association, reveals that many of them (1) were due to inadequate ventilation or (2) involved heating or ventilating systems or repairs. The first classification offers a field for education as to the importance of ventilation, whereas the second encourages closer checking on repairs and installations to ascertain that they conform to proper procedure.

With respect to the first classification, a large number of explosions and subsequent fires undoubtedly might have been prevented had there been adequate ventilation. Proper ventilation, while very important, is not the only method of preventing fires where flammable liquids and vapors are involved. As a matter of fact, there is some danger of relying too much upon ventilation. At times when employes wish to eliminate drafts, they shut down the ventilating system, or power failures may develop. Even where the ventilation is all that could be desired, a fire may be caused by careless handling, careless smoking, nearby sources of heat, static electricity, a spark from a tool, improper use of equipment or short circuits. Unfortunately, the exact causes of explosions, once they have occurred, are not always easily determined.

Welding under proper safety conditions. Nearby flammable objects are covered with flame-proof covers, and suitable fire extinguishers are at hand.

TABLE 1.—IMPORTANT WAR PLANT EXPLOSIONS AND FIRES THAT COULD HAVE BEEN AVOIDED BY PROPER VENTILATION.

Date	Location and Type of Plant	Circumstances	Loss
June 1, 1942	Canton, O., airport	Employees cleaning machinery with gasoline; vapors ignited.	$15,000; one workman burned badly.
June 3, 1942	Stockton, Calif., army property	Cleaning guns with gasoline; vapors ignited.	11 lives.
Aug. 7, 1942	Medford, N. Y., metal plant	Naphtha fumes ignited.	$140,000.
Oct. 29, 1942	Butler, Pa., steel worker	Paint vapors in spray booth ignited.	$495,000.
Dec. 21, 1942	Miles City, Mont., airport	Employees doping wing of plane; due to lack of ventilation the hangar became filled with explosive vapors. Flash fire occurred.	$21,000, exclusive of loss of training planes, not reported.
Jan. 2, 1943	Beardstown, Ill., airport	Blaze due to ignition of gasoline fumes when 110-volt automatic lighting plant was operated.	$11,000.
Jan. 29, 1943	Winona, Minn., airport	Fire started by ignition of vapors of gasoline in which plane parts were washed.	$125,000 (building and planes)

One of the most spectacular explosions and fires reportedly caused by inadequate ventilation and lack of explosion vents took place in Kearney, N. J., August 19, 1943, with a loss of $2,000,000 and 12 lives. According to N.F.P.A. reports, drying cells, utilizing naphtha solvent, were used for drying camouflage and were provided merely with sufficient ventilation to enable employes to work at the top level. Fans removed and replaced air through a duct system. The only additional ventilation provided was a window fan of 30 or 36 in. size at the ground level of the drying cells. The fans were of sufficient rated capacity to move the air content of the cell in 7 to 9 minutes. Apparently there was no provision for explosion venting.

Table 1 lists other important war plant explosions

TABLE 2.—IMPORTANT WAR PLANT FIRES INVOLVING HEATING OR VENTILATING EQUIPMENT OR THEIR REPAIRS.

(December 7, 1941 to March 7, 1944)

Date	Location and Type of Plant	Circumstances	Loss
Jan. 14, 1942	East Hartford, Conn., airplane factory	Welder was installing ducts, when spark ignited metal dust.	5 lives; 4 other persons severely burned; property loss not reported.
Feb. 6, 1942	Harrisburg, Ill., lumber yard	Fire was caused by a defective heater.	$36,255.
Feb. 22, 1942	Detroit, Mich., airplane factory	Fire occurred in ventilating system.	Not stated.
July 14, 1942	Midland, Ont., naval shipyard	High wind reportedly caused backdraft in boiler, igniting frame boiler house.	$186,000.
July 23, 1942	Pittsburgh, Pa., wood and leather plant	Fire in vent duct from spray booth.	$237,284.
Dec. 21, 1942	Near Lancaster, Pa., auto repair shop	Heater exploded.	$130,000.
Jan. 2, 1943	Meridian, Miss., wallboard factory	Explosion due to gas fuel accumulated in upper portion of dryer and heating duct system.	$250,000.
Jan. 3, 1943	Rome, N. Y., airport	Fire caused by improperly installed boiler.	$3,000.
Jan. 15, 1943	Orleans, Vt., woodworker	Fire believed to have started near a home-made unsprinklered spray booth constructed of matched boards lined with cardboard.	$58,500.
Feb. 11, 1943	Ellensburg, Wash., flour mill	Fire started in boiler room from a defective flue.	$105,000.
Feb. 16, 1943	Waterloo, Ia., woodworker	Blaze probably due to defective stovepipe.	$101,296.
Feb. 28, 1943	Near Marshall, Mich., metal worker	Fire caused by explosion of an oil furnace.	$44,500.
March 7, 1943	Steelton, Pa., steel worker	Fire broke out in vicinity of belt-driven heating system blowers and motors located on wooden platforms.	$100,000.
March 23, 1943	Quincy, Mass., lumber yard	Fire started from an oil burner.	$125,000.
April 9, 1943	Near Sacramento, Calif., warehouse	Workman removing pipes in engine room with cutting torch when spark flew through open door, igniting tires.	$104,831.
June 3, 1943	Cumberland, Md., rayon plant	A power failure interrupted operation of blower system and reportedly allowed acetone vapors to collect in duct. Welding work on the duct was started, igniting vapors and causing explosions.	$500,000.
June 21, 1943	Peabody, Mass., tannery	Fire started from an overheated bearing on a fan in a spray booth.	Loss not stated; approximately 66,000 feet of leather damaged by fire and water.
June 30, 1943	Bristol, Pa., warehouse	Fire started from a defective oil burner.	$75,000.
July 2, 1943	North Tonawanda, N. Y., chemical plant	Spark from an exhaust fan ignited a drip pan below fan.	$30,000.
Dec. 15, 1943	Near Dallas, Tex., magnesium bomb plant	Fire started in foundry section when a plywood exhaust duct near gas-heated foundry equipment, ignited from gas flame or sparks.	$550,000.
Dec. 23, 1943	Hagerstown, Md., airplane parts plant	Fire under vent from a spray booth flashed into the building through the fan.	Estimated to be several hundred thousand dollars.
Dec. 30, 1943	Lebanon, Ind., bus body plant	Spark from an exhaust fan ignited paint thinner.	$60,000.
March 7, 1944	Detroit, Mich., machine pattern plant	Spark from old chimney opening ignited open area between floors.	Estimated $300,000 to $400,000.

and subsequent fires that might have been prevented had there been adequate ventilation.

Fires Involving Heating and Ventilating Systems

Important fires involving heating and ventilating systems or their repair appear to have occurred largely from defective installations, sparks from exhaust fans, and repair work on ducts, such as welding without "first aid" fire protection equipment to extinguish incipient blazes. Excluded from the accompanying tabulation of these fires are those in which nearby combustible materials were ignited from overheated furnaces, steam pipes, and coal and oil stoves, as the objective is to determine causes of fires in the heating and ventilating equipment itself. However, the record of overheating fires and those due to makeshift heating apparatus emphasizes the need for efficient heating and increased fire protection in the vicinity of the system, whether small or large.

Fire Protection During Installation and Repair

Small fires, occurring coincidentally with the installation and repair of heating and ventilating systems, can be extinguished with first aid fire protection equipment. It would appear to be within the scope of the heating and ventilating engineer's activity not only to make certain that installations are made in accordance with approved fire prevention standards, but to make sure that first aid fire protection equipment is at hand in case of sudden emergency when installations and repairs are being made.

Although not in a war plant classification, the lives of 32 persons undoubtedly would have been saved in a sanitarium fire near Seattle, Wash., on January 31, 1943, had the proper type of fire extinguisher

been handy during the repair of an oil heater. Repairman lighted a match and the head blew off, landing in spilled oil. The resulting fire took 32 lives.

Three Classes of Fires

For first aid fire extinguishment, fires are classified by Underwriters' Laboratories, Inc., into three groups, as follows:

Class A—fires in ordinary combustibles, such as wood, paper, etc.

Class B—flammable liquid fires.

Class C—electrical fires.

Class A fires are best put out with water, which has a cooling and quenching effect. Fire extinguishers that contain water or chemicals and water are the soda acid, foam, pump tank, gas cartridge and loaded stream types. Vaporizing liquid and carbon dioxide extinguishers are useful for controlling small Class A fires, if they are not deep-seated and there are no strong air currents to dissipate the vapor or gas.

Fires in flammable liquids, grease, etc. (Class B), require a blanketing effect to cut off the oxygen supply. Suitable extinguishers are foam, vaporizing liquid, carbon dioxide, and loaded stream.

Class C fires require the use of extinguishants which will neither damage the equipment nor convey an electrical charge along the hose stream to the operator. Vaporizing liquid and carbon dioxide extinguishers are suitable for fires of this class.

The Underwriters' Laboratories' label on every approved fire extinguisher indicates the class or classes of fire for which each extinguisher is considered suitable. Instruct someone of each installation gang in the operation of the various types of extinguishers, or it may be possible to request of the building management a "watcher" with equipment and knowledge of small-fire extinguishment. Usually there will be extinguishers on the property.

Repairing and Welding Ventilating Ducts

In repair work, it is best to survey surroundings for flammable materials of any kind that may be ignited by sparks. If there is any fire danger, no smoking should be the rule. Extraordinary precautions should be taken where flammable liquids or their vapors are present. First aid fire extinguishing equipment should be immediately available at all times.

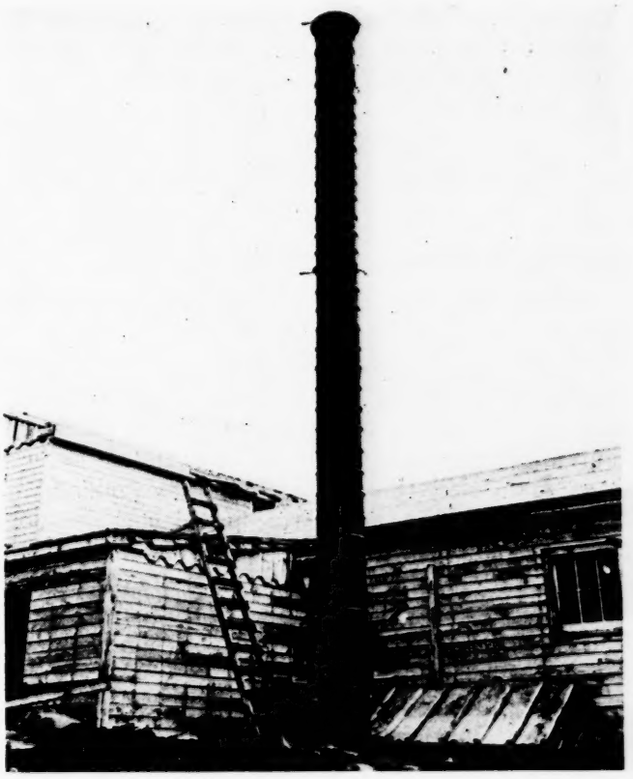
In welding ventilating ducts, if the proper precautions are observed, fire will not only be less likely to occur, but will be extinguished while in the incipient stage.

Rules to be observed when welding ducts include:

1. Use equipment that is in good operating condition.
2. Do not weld in the presence of flammable liquids or vapors.
3. Sweep ceilings, floors and surroundings clean and wet down wooden floors or ceiling, or protect with sheet metal, flame-proof canvas or something equally protective.
4. Move combustible materials at least 40 feet away, if possible, otherwise protect as previously noted.
5. Before beginning repair work on ducts, remove inside deposits from ducts and collectors, etc.
6. Provide, or request, extra men to watch sparks that may fly to the floor above or below through openings, such as cracks or doors.
7. Provide, or request, sufficient hand or wheeled fire extinguishers of the proper type to extinguish immediately any fire that may start.
8. When the work is completed, inspect thoroughly the entire area and keep a watcher on location for at least a half-hour.

Proper Installation

A point that should be especially emphasized is the importance of proper installation of heating, ventilating and air conditioning systems to avoid the danger of spreading fire and smoke throughout a building by means of the duct system. An exhaust system for reducing fire hazards by taking away flammable vapors, unless it is properly installed, may in itself create hazards just as severe as those it was designed to eliminate. N.F.P.A. Standards on Blower and Exhaust Systems and on Air Conditioning cover this subject fully, specifying suitable dampers in ducts to close automatically in case of fire, and other safeguards.



Characteristc Yankee ingenuity was displayed by the Seabees, the construction group of the U. S. Navy, when they needed a smokestack for a boiler heating a dispensary at one of the Aleutian bases. The smokestack, about 50 ft high, was constructed of 12 used oil drums, welded together.

Refrigeration in Dam Construction

W. R. WAUGH

Materials Engineer, TVA Fontana Dam, Fontana Dam, N. C.

Fig. 1. Close-up of a connection being made outside of a form. Connection manifolds are shown.

REFRIGERATION is playing a vital and important part in the construction of Fontana Dam, which is the seventh and largest tributary storage dam constructed by the TVA in its unified river development program. In addition to its normal position in the unified program, Fontana Dam is being rushed to completion under a "forced draft" construction schedule as a part of the wartime emergency program of the TVA to make available additional power for war manufacture purposes. The dam is located on the Little Tennessee River in Western North Carolina, south of Knoxville, Tenn., and west of Asheville, N. C. It is a concrete masonry structure and when completed will be approximately 480 ft high and will contain 2,800,000 cu yds of concrete.

Cooling Problems and Objectives

Several problems in connection with mass concrete construction arise out of the fact that large quantities of heat are generated when the hydration of cement takes place. The physical dimensions of a mass concrete dam determine to a large extent the importance of these problems. Because of the Fontana Dam size, these problems are magnified into major importance, and extra special considerations are necessary with regard to both design and construction schedule. These problems were further amplified by the necessity for construction speed.

To appreciate the magnitude and importance of these problems, it is first necessary to understand the composition and behavior of portland cement concrete. The three ingredients of portland cement concrete are aggregate, cement, and water. The aggregate, which occupies a large majority of the volume of the hardened concrete, is inert. The cement and water, however, are very active chemically, and the chemical action which results in hardening of the cement paste gives the concrete its strength. This chemical process, called hydration, is accompanied by the generation of large quantities of heat. The amount of heat generated is in exact proportion to the amount of cement of given characteristics used per unit of concrete volume. Therefore, as a first step in the control of any problem arising out of heat generation, the cement content is reduced to a very minimum, commensurate with strength, workability, and other requirements of the concrete. In this dam, most of the interior concrete contains 0.80 barrels of cement per cubic yard.

Heat generated causes a rise in temperature with a corresponding increase in volume, and some of the heat is dissipated into the air. This heat loss in the early life of the concrete depends on the thickness of the concrete layer placed, and the time elapsing before an additional layer of concrete is placed. Therefore, it can readily be seen that by limiting the thickness of the layers in which the concrete is placed, and the time elapsing between placing successive layers, the temperature rise and subsequent fall can be partially controlled. For economic reasons it is impossible to rely entirely on these means. The most economical thickness of lift, judging by practice in many recent mass concrete dams, is 5 ft but it is sometimes found necessary to place thinner layers, in which case the usual practice is 2.5 ft.

After the concrete has reached its maximum temperature, cooling and corresponding shrinkage begins. If the concrete was placed on a restraining base such as the rock foundation of a dam, two actions take place. First, as the temperature rises and the volume tries to increase, there is a tendency to set up compressive stress. Because in the early life of the concrete the material is more plastic than elastic, it "flows plastically" and the stress is largely relieved. Second, as the temperature drops and the volume tries to decrease, there is a tendency first to relieve any compressive stress set up and then to set up

tensile stress. When the second action takes place, the concrete has reached a stage where it is becoming more elastic and less plastic, and tensile stresses are set up. If these stresses become larger than the concrete has resistance to withstand, then tensile failure occurs. This is evidenced by the formation of cracks. If these cracks are large and extensive, they become a menace to the safety of the structure because they may divide the structure into units which the designer did not visualize in his analyses.

The "final stable" or cooled-off temperature of the concrete is fairly definitely fixed and is the temperature to which the structure would cool if left to natural cooling. The temperature of the concrete as placed (placing temperature) varies with the season of the year and is, therefore, fairly definitely fixed. In winter, placing temperatures are maintained at a safe level to prevent freezing the fresh concrete. This is done by heating the mixing water so that temperatures are maintained above 40F but below 50F.

In summer, placing temperatures reach 78 to 80F in extremely hot weather. Since the temperature rise cannot be held economically within the required limits, it becomes necessary to use forced cooling. It is in this respect that refrigeration is necessary and is playing such an important part in the construction of Fontana Dam.

The first cooling problem resolves itself into keeping the temperature rise and subsequent fall low enough to hold the developed tensile stresses safely within the concrete tensile strength. In a dam such as this, with a base width of 350 ft, precautions against excessive tensile stress would have been necessary in 50% of all the concrete in the dam. This would have required a very large artificial refrigeration capacity with at least two separate installations, one of which would have been used for reducing the placing temperature (temperature of the fresh-mixed concrete), and the other for artificial cooling of the concrete as it hardened. This scheme was never tried before and was impractical for trial at Fontana.

Another solution to this problem presented itself to the designer and was subsequently adopted for use. That solution used involves the introduction of longitudinal joints in the construction of the dam. These joints reduced the regions of high restraint to approximately 15% of the dam volume. This eliminated the necessity for a large-scale refrigeration installation.

Introducing the longitudinal joints made the dam into four massive columns instead of one gravity monolith, with grouting necessary for joining the columns together. Before this can be done, each column must be cooled to the final stable temperature so that normal shrinkage will be completed. To reach this condition by natural cooling would require more than 50 years. Forced cooling prevents or greatly reduces the formation of cracks on the exposed dam faces and on "bulkhead" faces of the blocks. This might occur in an uncooled dam exposed to variable air temperature during the period of maximum interior temperature.

The problem arises as a result of large temperature differences between the interior of the concrete mass and a relatively thin exterior portion, when

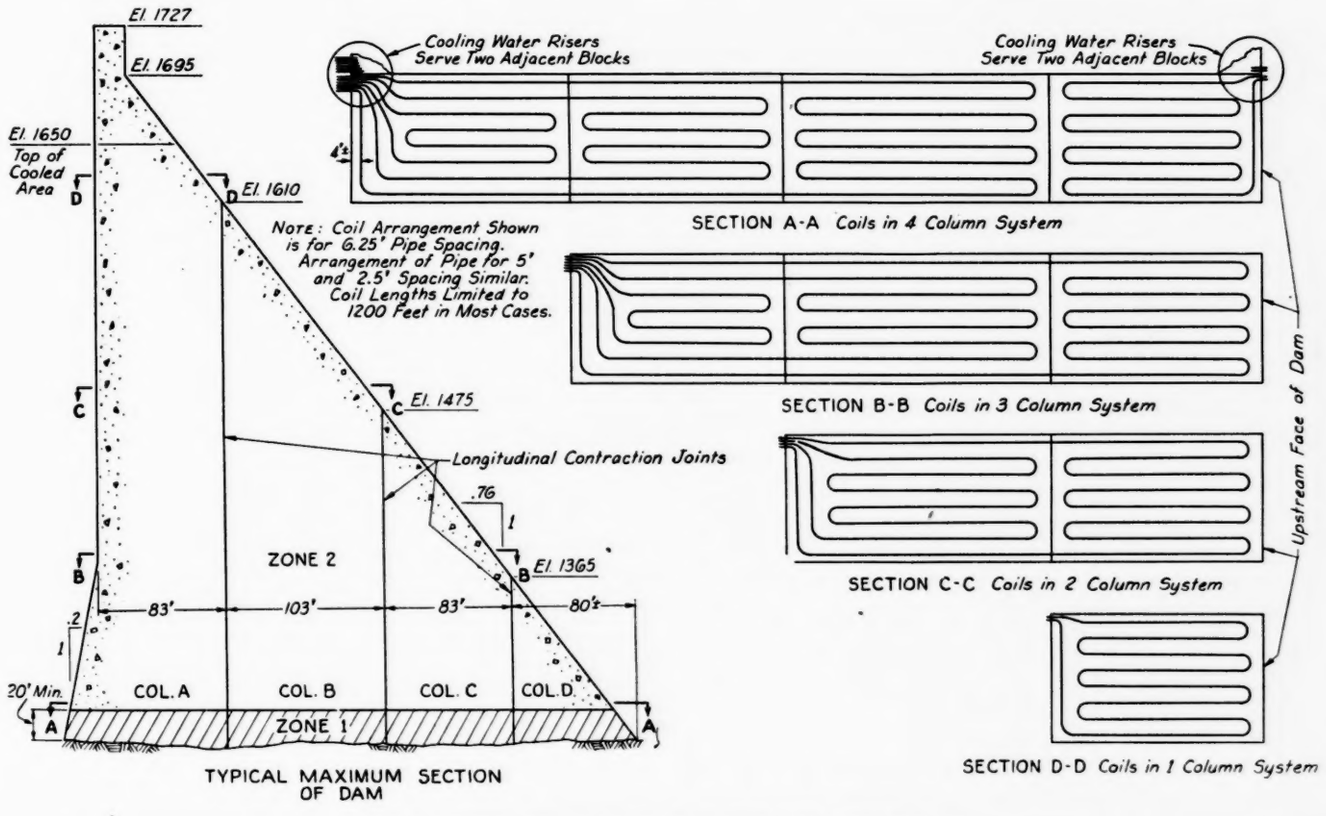


Fig. 2. Cross connection of dam and coil arrangement.

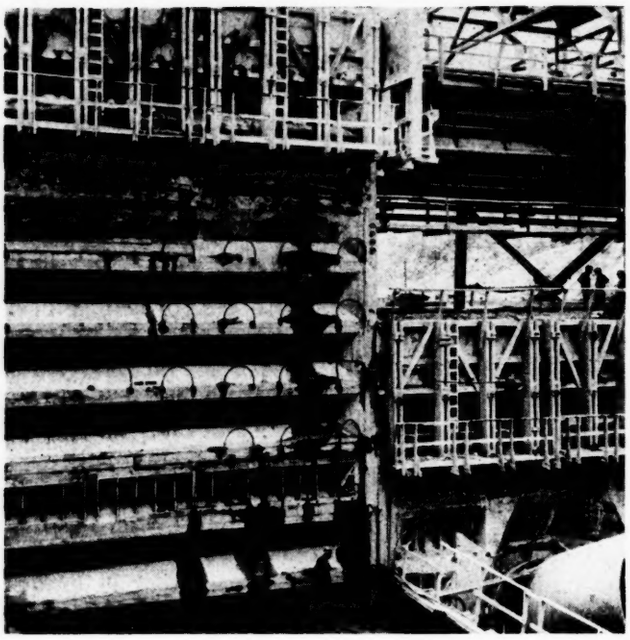


Fig. 3. Temporary connections for upstream side of column before adjacent column is poured.

extreme drops occur in air temperature. This condition is possible in any reasonably large mass of concrete which is dependent on natural cooling for dissipation of the heat. Concrete placed in early spring may not crack until the following winter during the first sharp drop in air temperature. Where artificial cooling is used, the occurrence and size of cracks are materially reduced, if not entirely eliminated.

Cooling Procedure

Forced cooling is accomplished by circulating either refrigerated water or river water through coils of pipe embedded in the concrete. The dam is divided transversely by contraction joints into blocks 50 ft wide. Each block is further divided into columns by three longitudinal contraction joints. There are two principal reasons for dividing the dam transversely: first, to provide convenient working units; second, to control the location and shape of contraction joints which would naturally form if the monoliths were extremely wide.

After a layer of concrete has been placed and has become hard, the cooling pipes are installed and anchored to the surface by means of wire anchors embedded in the soft concrete. After the coils have been tested for leakage and circulation, and all other necessary items of work are completed, concrete placing is resumed provided the minimum specified exposure time has elapsed between pours. One prerequisite to resumption of concreting is that water shall be circulating through the coils before concrete placing can start.

Cooling coils are 1 in. o.d. black steel tubing. Tubing is furnished in both straight lengths and 180° return bends. All tubing has plain ends and is connected by means of expansion couplings for rapid installation. The return bends are furnished in 2.5, 5, and 6.25 ft diameter bends to fit pipe spacings. All coils are terminated in the downstream face of the dam, except in the base of the dam where there are four columns; coils for the upstream column (Column A) are terminated at the upstream face. Embedded in the top of each concrete pour at the downstream face (and upstream face where required) are goosenecks which provide connections for the coils to the outside water supply. Water circulation can be started before concreting begins and continued without interruption when the forms are raised.

The construction schedule is arranged so that the downstream most column (Column D, C, or B) is usually started first, and the upstream most column (Column A) is usually started last, with the intermediate columns (C and/or B) forming a stairstep sequence from downstream to upstream (Fig. 2). This arrangement simplifies piping to coils in the interior columns. Pipes placed in a column to serve coils in other upstream columns were provided with temporary connections (See Fig. 3, picture of loops on upstream side of Col. D.) and connected to the other coil or coils in a column until concrete in the column which the pipes were intended to serve is poured up to the level of the pipes.

Water Connections

Connection of coils to the cooling water supply at the faces of the dam is by means of rubber air hose. Adapters are attached to the end of the goosenecks which carry on the open end a 1 in. quick-acting universal Dixon Air King hose coupling commonly called a crowsfoot by the workmen on the job. Manifolds are provided at convenient intervals, and several lengths of hose are attached to each manifold by means of air hose steep nipples. The opposite end of each hose carries a crowsfoot by which connection is made to the gooseneck. Each manifold is separated from the supply riser by a valve. On the large six- and nine-opening manifolds, a plug valve is provided; on the smaller job-made manifolds with two and three openings a gate valve is provided.

In the sections of the dam subject to foundation restraint (called Zone 1), the horizontal and vertical pipe spacing, the lift thickness, and the elapsed time between successive lifts are dictated by the concrete placing and air temperatures. In winter, when air temperatures and placing temperatures are low (below 55F), concrete is placed in 5-ft thick layers, and cooling pipe is spaced 5 ft o.c. horizontally on top of each lift. In spring and fall, when air temperatures and placing temperatures are moderate (55 to 65F), concrete is placed in 5 ft thick layers, and cooling pipe is spaced 2 1/2 ft o.c. horizontally on top of each lift. In summer, when air and placing temperatures are high (65 to 75F), concrete is placed in 2 1/2 ft thick layers, and cooling pipes are spaced 2 1/2 ft o.c. horizontally on top of each lift. The

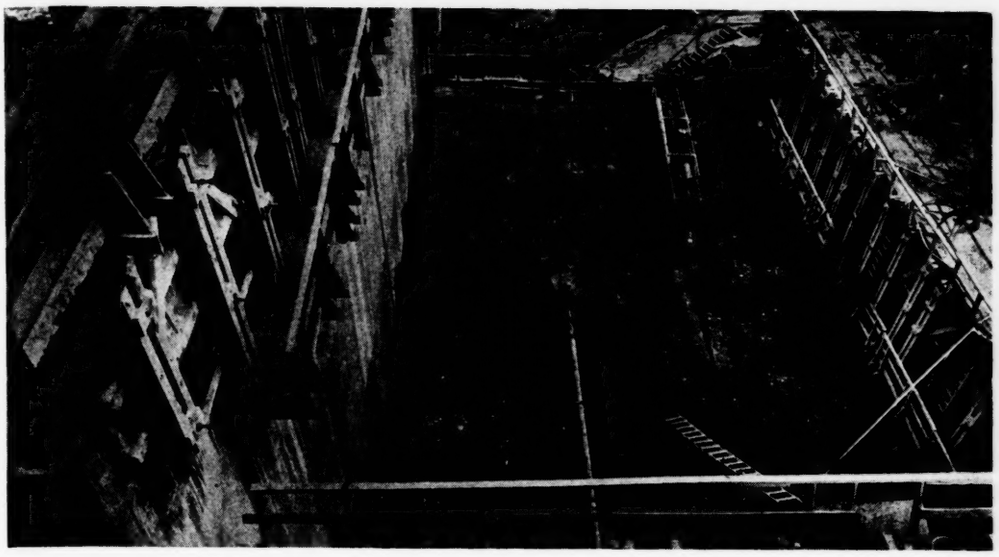


Fig. 4. View of typical coil layout for 2½-inch pipe spacing.

interval between successive 5-ft lifts is 3 days and between successive 2 1/2-ft lifts is 2 days.

All these limitations were set by the designers and were based on theoretical studies intended to limit the temperature's rise and fall and, consequently, the magnitude of the tensile stress set up.

In addition to these limitations, four others were specified to correct faults which might arise out of the cooling operation itself. Where it was necessary to place concrete at temperatures 15F or more higher than final temperature, a minimum cooling period of two months for completion is specified. In most instances, it was not possible to complete cooling in less than two months, but where it was obvious that it could be, cooling was interrupted for a period of time and then resumed. The time limitation was specified to allow for some relief of tensile stresses being set up by the cooling process and thus further reduce the tendency to crack.

When concrete in Zone 1 was placed at a temperature of 65F or higher, cooling with refrigerated water was started immediately and was continued until the temperature of the concrete was 10F below placing temperature before interruption. This specification complements the first by insuring that as much temperature reduction as possible be accomplished in the early life of the concrete while the concrete is still relatively plastic. Where placing rates were slow, cooling was interrupted when the concrete was cooled to the placing temperature, if less than 10 feet of concrete had been placed above the level being cooled. This limitation conflicts with the second limitation previously stated and takes precedence over it, but such situations rarely arose.

On abutments where large differences in elevation existed between the high and low sides of a block, all concrete in the triangular-shaped base of the block below the elevation of the highest point of the rock was cooled to final stable temperature before the block reached an elevation 30 feet above the highest rock. This limitation is intended to prevent tilting which would result from differences in total shrinkage on opposite sides of a block, if cooling was delayed until the block had reached a great height where one side was 30 to 50 feet higher than the other side. It was necessary to use refrigerated water to accomplish this in spring, summer and fall.

In regions not subject to foundation restraint (called Zone 2), the only problem involved is that of completing the cooling so that grouting can be accomplished. Zone 2 comprises about 75 to 78% of the concrete in the dam. About 7 to 10% of the total concrete does not require forced cooling but rather will be left to natural cooling.

(To be concluded. Part 2 describes the River Cooling Plant)

Illicit Anthracite Coal Mining Reduced

The output of anthracite by the illicit mining industry, according to the U. S. Bureau of Mines, declined from 3,931,000 tons in 1942 to 1,912,000 tons in 1943. 1941 output estimated 5,000,000 net tons.

A survey in March, 1941, indicated that 10,762 men were working 3,006 bootleg holes, while in October, 1943, 2,725 men were employed in 791 holes. In March, 1944, the number of bootleg holes had decreased to 652 and the number of men employed had decreased to 2,220.

Information gathered in May, 1942, showed that 45% of the men and boys working in such holes were less than 30 years old. A comparable survey made in March, 1944, indicated that because the younger men were entering the armed forces, the percentage of men under 30 years had declined to 28%.

Service Hot Water for the Large Building

F. O. JORDAN

Mechanical Engineer, Albert Kahn Associated Architects and Engineers, Inc.

THE service hot water system for the office building or for the industrial plant basically serves the same purpose as in the ordinary home. It involves heating the required quantities of water, generally under some sort of control, and distributing it to the proper locations. However, the difference in size, population and demands make the problem of hot water service much more complicated for the larger type structure.

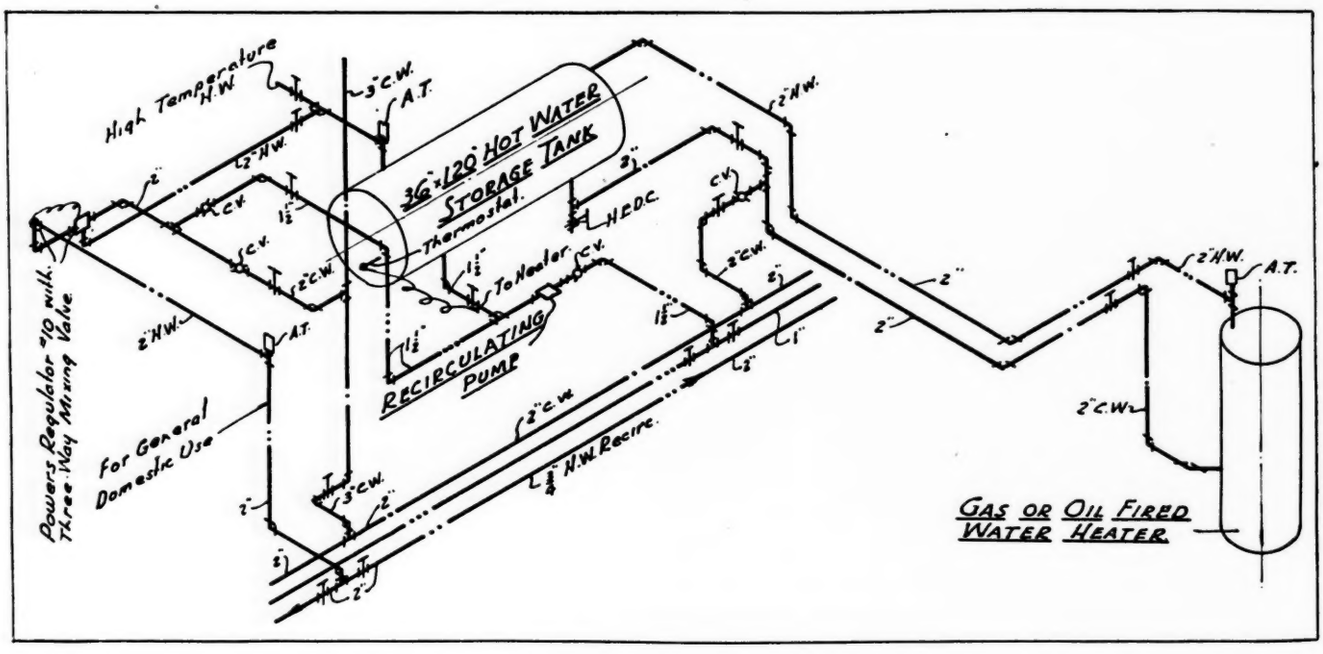
In many industrial buildings, a hot water service that provides water at only one temperature will not be satisfactory. Water at 180F or higher may be required for kitchen, laundry or process usage. Supplying water at such high temperatures for bathing and hand washing is unsatisfactory, or even dangerous. Of course the bather may regulate the temperature to his liking by manipulation of hot and cold water supply valves, but so much throttling of the hot water valve with hot water at such high temperature becomes critical and difficult. Furthermore, severe scalding cases are unavoidable.

It may be accepted as a general rule that any building where water in excess of 120 or 130F is required for special usages should have a two-temperature system, one system for supplying water at the high temperature required for the special usage, and another system for supplying water at 110 to 120F for general usage.

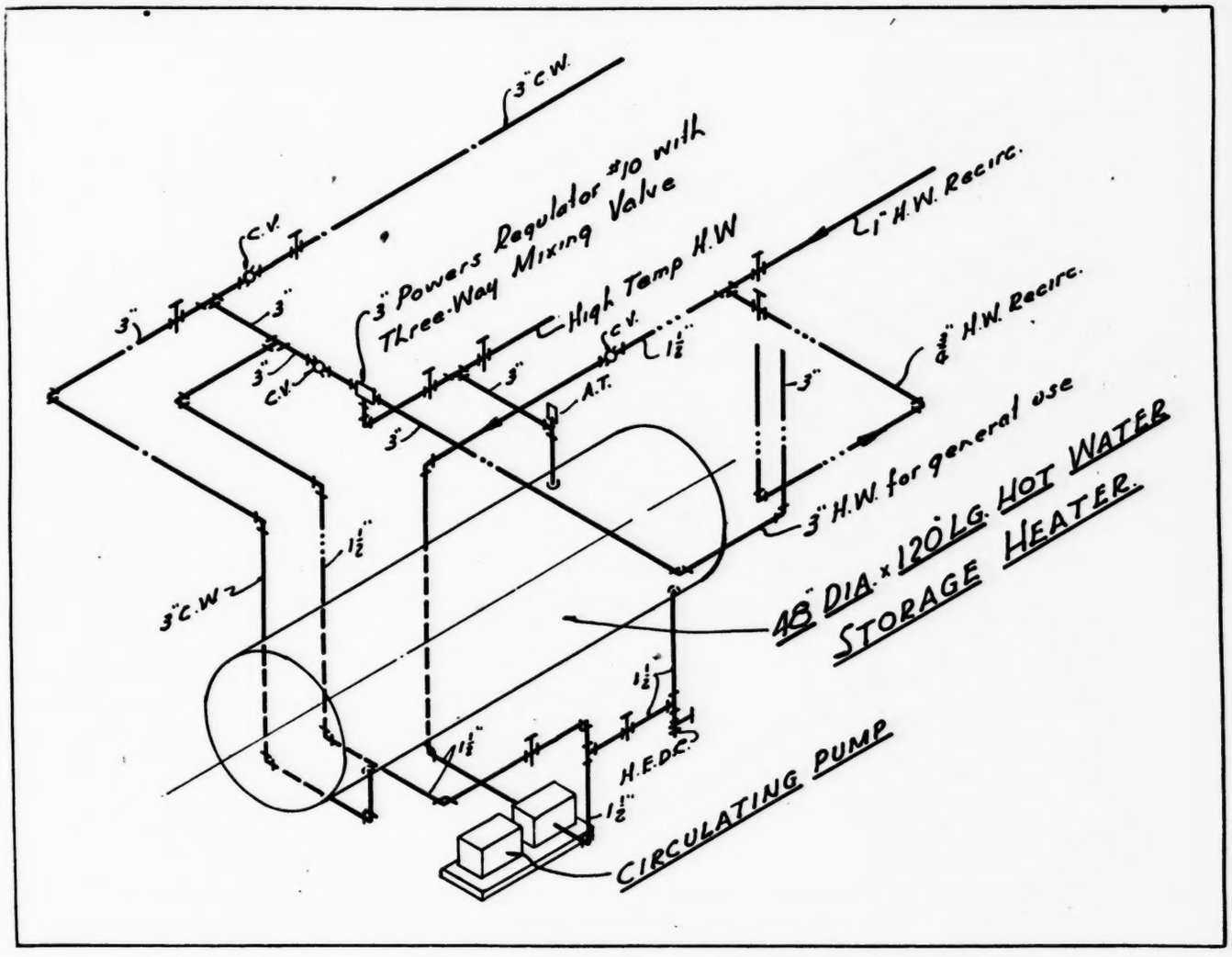
Each system may be provided with its own water heater controlled to supply water at the required temperature. A more economical and perfectly satisfactory method is to install one heater regulated to supply water at the temperature required by the high temperature system, and to take the supply for the low temperature system through a modulating type, thermostatically controlled three-way valve. This valve automatically mixes cold water with the high temperature as required to obtain the necessary water temperature reduction for the low temperature system. Such a one-heater, two-temperature system is shown in Fig. 1.

In the ordinary home, the length of pipe between the heater and all of the faucets is so short that not very much cooled "hot" water can lie in the pipe, even after considerable periods when no water flows through any faucet. Therefore, not much water is wasted, nor does much time elapse waiting for the hot water to arrive after the faucet is opened. But the larger building with its long runs of hot water piping is another story. Here, many gallons of water may be wasted and many minutes may pass before hot water, not tepid, flows from the faucet. Waste of water and loss of time from this cause in a large building would be enormous.

To save both in water and time, any building, except a very small one, should be provided with a hot water circulating system designed to keep the hot water in the entire system moving rapidly enough



Two-temperature system gas or oil fired heater



Two-temperature system steam coil heater

to prevent too much cooling off. Therefore, circulating connections should be taken from the ends of all runs of hot water piping and a hot water circulating main should be run back and should be connected to the heater. The piping should be installed so that hot water is kept circulating in the mains or branch main quite close to the fixtures.

For large buildings, hot water circulating systems may roughly be classified as "grid" systems and "loop" systems. The grid type of system may be briefly described as a system of hot water distributing mains and branches laid out as required to supply hot water to the points of usage, with a similar system of circulating mains and branches connecting to the ends of all runs of hot water piping and running back to the heater. In the loop system, the main is installed as a loop running from the heater around the building in such a way that it passes close to all points where hot water is required, and returns to the water heater. Generally speaking, the grid system is more suited to multi-story buildings while the loop system can be installed profitably in large single story factories.

A hot water circulating pump may or may not be required. In the tall structure the pump may not be necessary because thermal circulation naturally is more effective in a system of considerable static head and mains are not likely to be long enough to offer excessive friction head unless the building covers a large ground area. A circulating pump becomes necessary for the lower building, where thermal circulation is weak, and for buildings of large ground area where mains are long and frictional resistance to water flow is great.

It is necessary for the circulating pump to circulate only a very small percentage of the water supplied through the system. The quantity to be circulated generally is calculated on the basis of limiting the water temperature drop in the system to 10F, considering the heat lost by radiation from the hot water distribution piping. When a building is so tall, or the water pressure is so low that a pump must be provided for maintaining the required water pressure at the highest fixtures, we have an entirely different problem, and the pump is known as a "booster" pump. When a booster pump must be installed for supplying the upper floors of a building, the pressure in the city main, transmitted through the heater, generally is sufficient for taking care of the lower floors.

Therefore, it is generally advisable to divide the piping system into two parts, one using city pressure for supplying the lower floors and the other part being provided with a booster pump for supplying the upper floors where the city water pressure is incapable of maintaining such high pressure.

In most cases, the service hot water for large buildings is heated by means of submerged steam coils, although gas, oil and coal fired heaters are sometimes found. Mainly, the heaters are of the storage type in which a quantity of hot water is held in reserve, although instantaneous heaters which heat water as it is needed give satisfaction if the hot water demand is constant and continues over long periods. If the hot water demand comes in short, high peaks, a much smaller heating coil will suffice. The steam demand for water heating will be much more constant if a storage type heater is installed, as the heater will keep on working between peaks to store water for the peak demand. General practice is to install a heating coil with sufficient surface to heat the total quantity of water required during some period, while the storage tank is made large enough to take care of the peak demand during its duration. An example of a peak demand is a factory where the workers wash up during the 15- or 20-minute period immediately following quitting time.

In designing the hot water supply system, all locations where hot water will be required must be ascertained and the water demands determined. Tables are available for estimating water quantities, although a thorough understanding of the usage of the building is necessary in determining maximum and hourly requirements. Care must be exercised to size the supply piping so the pressure loss through the system after being deducted from the initial pressure leaves enough pressure at the furthest fixture for satisfactory flow.

The design of the circulating system is based on the quantity of water that must be circulated to limit the temperature drop through the system to about 10 degrees. Therefore, the number of pounds of water to be circulated per hour is obtained by dividing "10" into the Btu of heat lost per hour from the piping system. If a circulating pump is installed, it must have capacity for pumping the calculated quantity against the friction head of the system.

The usual approved practices followed when installing piping systems of this class should be observed. Connections should be made to allow for expansion without strain on pipe and fittings. Low points in the system should be provided with drain valves unless they may be drained through fixtures or the heater. High points should have automatic air relief valves. Branches should be valved and sectional control valves should be installed as required for proper control of the system. Unions and hangers should be installed in accordance with good pipe fitting practices. Pipe and fittings should be galvanized iron or steel, or should be copper tubing, especially if local conditions indicate excessive corrosion, or if the pipe lines are inaccessible for repair.

Coal Needed for Each Ton Used in a Boiler Plant

It is hard to conceive of anything we do that does not use fuel directly or indirectly. Production, communication, transportation, all require fuel. While the problem of tracing the tons of coal, equipment and material required to deliver one ton of coal to the boilers is endless, there are certain places where the coal usage incident to that one ton of coal consumption are more readily known. They are the railroads and the mines.

In delivering this one ton of coal the railroads will consume 0.25 ton in hauling and switching and in the pro-rated usage including that at engine houses and shops. The one ton will travel 360 miles, the average haul by rail. Fifty tons will fill one hopper car with either bituminous or anthracite, and over 20 days are required per round trip. Ever increasing transportation difficulties are increasing this turnaround time and with it the size of the stock pile in transit at the expense of stock on hand. Thus, each ton of coal saved will require less of many things, such as weight to haul, coal cars, locomotives, train miles and crews, wear and tear on railroad facilities, and less interference with war transportation by slower moving coal trains.

It took some coal miner about one-third of a day to produce the 1¼ tons of coal at the mine. It also took mine timber and cut lumber, steel, copper, machinery, and operating and maintenance supplies at the mines.

At the retail yard, delivery included, one ton of coal saved per day would in one week save one man day, an average of 20 truck miles and 80 gallons of gasoline, plus wear and tear on truck and tires.

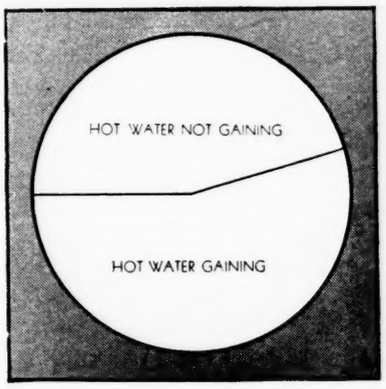
Now back to the boiler room where that ton of coal is consumed, wisely or unwisely. Here we find a lot of boiler plant auxiliaries. These are, in the main, electrically operated. All take something that came from the burning of fuel. Such equipment is more numerous than we realize until we take inventory. There are fans for forced and induced draft and ventilation, pumps for boiler feed, cooling water, condensate, oil and feed water, coal crushers, automatic coal scales, stokers, coal handling, and ash handling systems. Steam is used for soot blowing. This is a major, though partial, list.

Now the fuel used for all this is not large relatively, only about one percent, and this could easily be surpassed by lack of efficient boiler operation. In many plants an item of one percent means many tons of coal per day. This shows the added importance for proper maintenance and operation of the auxiliaries.—*T. W. Reynolds.*

Radiant Heat, Air Sanitation Hold Post-War Promise

CONTINUED interest in radiant heating and increased awareness on the part of building owners to air cleaning are forecast in a survey made by HEATING AND VENTILATING of over 1300 consulting and architectural engineers, two-thirds of whom are now engaged in design and specification of post-war projects.

Twelve questions were asked in the survey; two related to fuels and an analysis of the replies to those two were the basis of the article entitled "Engineers' Opinion on Post-War Fuels Unaffected by Current Shortages" in last month's issue.



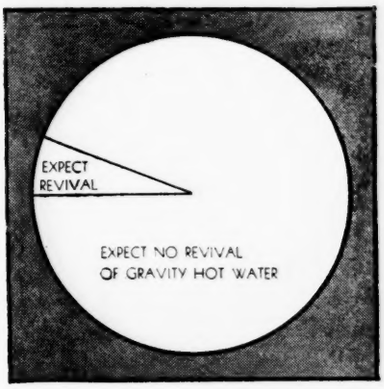
Tendency for hot water heating to continue to encroach on steam heating.

In reply to the question *Do you note any tendency for hot water heating to continue to encroach on steam heating?* 54.5% gave a flat Yes, 45.5% a flat No.† In addition there were a number of qualified answers among which were the following:

Yes, in smaller structure; for larger buildings over 3000 sq ft steam and differential vacuum return system.
Yes, particularly in residential and comparatively small buildings.
Only in connection with radiant heating and small residential work.
Decidedly for residences, small apartments and small office buildings.
Yes, for small and medium residence jobs.
Yes, especially one-pipe systems for large buildings.
Believe the tendency will be in favor of hot water heating in connection with radiant heating for residences and non-commercial and non-industrial buildings, for residential, social and recreational, institutional, and religious buildings.
Only to a limited extent.
Hot water not suitable here (Louisiana) for small houses. Very desirable for larger installations.
Decided trend to hot water heating systems from so-called winter air conditioning.
Yes, but only as regards panel heating.
For residential installations yes, but commercial buildings no.
Yes, but air conditioning to outstrip both.
Yes, if radiant heating proves practical.

†Editor's Note: Compare these figures with the following. In the fall of 1943 Minneapolis-Honeywell Regulator Company announced a $10,000 prize contest on personalized apartment house control, using either steam or hot water. The contestants, totaling 513, submitted plans divided thus: One-pipe steam, 12.3%; 2-pipe steam, 30.8%; 1-pipe hot water, 22.2%; 2-pipe hot water, 24.5%; steam, radiant, 1.4%; hot water, radiant, 8.8%, so that the totals were: Steam, 44.5%; hot water, 55.5%.

Those surveyed were asked the question: *Do you expect a revival of gravity hot water heating?*



Possibility of a revival of gravity hot water heating.

Of those surveyed, 10% gave a flat affirmative answer; 90% a flat negative answer. In addition, among the qualified or unclassifiable comments were the following:

Yes, for small dwelling houses.
We hope not.
Gravity hot water is okay but most domestic heating units have more sales appeal with equipment such as a circulator, etc.
Yes, on low cost work.
No, I think even the existing hot water gravity systems will be changed to forced hot water systems.
No, but we look for a revival of the vapor-steam 2-pipe systems.
No, gravity hot water a system of the past.

Of those responding to the survey, 55.3% had favorable comments to make regarding radiant heating in reply to the question: *How does radiant heating look to you in regard to its advantages and limitations?* However, 24.5% regarded radiant heating unfavorably, 12.8% had no opinion, and 7.4% were unclassifiable.

The comments on this question were particularly interesting and included the following:

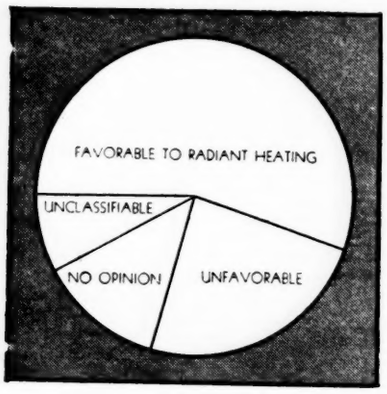
We feel that radiant heating has great possibilities

in a definite field but that unless it is engineered with great care there will be serious complications and complete failure.

Favorable if price can be made comparable.

Has many advantages, but a few limitations which cannot be eliminated.

We look for this to be the most significant step in post-war construction, although perhaps not large in volume.



Opinions as regards possibilities for radiant heating.

For special conditions radiant heating has possibilities.

Where the climate is not too severe radiant heating seems to be ideal.

Should be more fully developed.

We expect to use radiant heating more than ever but limited to certain parts of the buildings, using air, water and steam for other parts as before.

Limited but fine for supplementary work.

Too expensive and too slow for this climatic belt (Southern Wisconsin).

Great possibilities but doubt its general use in this climate (Florida).

Not practical in our climate (Texas).

Foresee increasing demand, particularly in homes.

Definite advantages for many jobs but will not replace conventional methods to any great extent for some time to come.

For certain special conditions.

A lot of talk.

I am much interested but not sold. We have so many days that heat is required for one or two hours (New Orleans).

Not favorable for schools.

Pipe manufacturers' dream.

Don't look good, never did.

Very interesting; expect to see development of hot air panel heating to compete with hot water.

Has advantages sufficient to lead us to expect an increase in its use, but method is by no means a cure-all and will not supersede other methods.

Expect a real field in the use of hot air in radiant heating.

This type of heating has greater possibilities than any other. Has yet to be exploited.

At present a rich man's plaything.

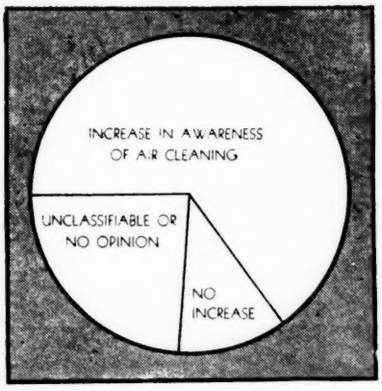
All limitations and very few advantages from my viewpoint.

We are much interested but it appears too expensive in this territory where temperatures are low (Connecticut).

Good for high quality work.

Not yet sufficiently developed.

Owners of buildings are becoming more and more conscious of air cleaning as an important function of air conditioning, according to the replies to the question: *Do you find an increasing awareness on the part of your clients as to air cleaning?*



Tendency on the part of clients towards air cleaning.

To this 59% replied Yes without qualification and 8.9% replied in the affirmative with some qualification, making a total of 67.9% giving answers the sense of which was in the affirmative. As opposed to this 14.5% gave a flat No; 0.5 a qualified No, a total of 15.0% answering in the negative, while 17.1% of the replies were unclassifiable or had no opinion.

Among the comments on this question were:

Yes, but there is room for further development.

Yes, the electrostatic air cleaner has worked well here (Southern Indiana).

Yes, very extended interest.

Yes, but filters are not fully satisfactory.

Yes, very important in this area (Pittsburgh).

Yes indeed, we hear a lot about this from our clients for the air is very bad in this district (Pittsburgh).

Prefer the Precipitron method where possible.

More attention should be given to ventilation and odor removal filters.

I think it has some value but that advertising has exaggerated the benefits.

Most air cleaning systems lack adequate cleaning.

Yes, but more thought should be given to accessibility for cleaning.

I think air sanitation is in its infancy.

Air cleaning is particularly important in the food and pharmaceutical industries.

Look for cheaper systems of electric precipitation.

Air cleaning is necessary in Southern industrial centers (North Carolina).

Better maintenance of air filtering equipment necessary in most installations.

Dust, not temperature, is greatest problem in this area (West Virginia).

Only for specialized field such as hospitals, laboratories, and industrial plants.

Clients do not like to clean filters.

Not a problem in this locality, mountain air does the trick (Portland, Oregon).

Air sanitation is one of the greatest things ever created.

Air cleaning should receive more attention. I have been impressed with the absence of dust in the ——— building where air is carefully cleaned (Los Angeles).

Filter cleaning is the biggest problem in connection with air cleaning.

Very desirable but most systems are not operated properly after installation.

Need for air sanitation is increasing.

Primary application is in industrial field.

In this area we are still inclined to prefer open windows and untreated air (Jacksonville).

Only in commercial work.

No, too much difficulty in having clients keep filters clean—they usually pay no attention until circulation has almost stopped.

Yes indeed. Even here it will pay (Los Angeles).

Yes. Highly desirable and often economical in reducing charges for cleaning and painting.

Air sanitation, generally speaking, will have to be much improved.

Yes—but they don't like to spend necessary money for a good filter job.

Would like to see electrostatic cleaners made available at low price.

Many plants complain of the effects of dirty air. Very few ask that filtering devices be provided. Many owners do not maintain filters after they are installed.

A phase of air sanitation that is often not utilized by engineers, is vacuum cleaning to permanently remove dust and dirt from spaces that are heated and ventilated.

Believe most people look forward to increased use of electrical or electronic devices for this purpose, but without any real information at present as to types, etc.

A subsequent article will present the replies to questions on need for further development, how the war has affected post-war designs, and other trends.

Control Measures in Munition Plants

A study of problems in munition plants led to the conclusion that local exhaust ventilation systems for these plants must contain positive type exhausters such as centrifugal fans; they must prevent the accumulation of explosive materials in the ducts and exhausters; they must permit routine cleaning operations; they must present a minimum of projections on the inside surfaces for the collection of the explosive contaminants; and they must be properly grounded. The second is most important as if it is met adequately, the others are minimized and present no serious problems. Careful consideration of this indicated that it could be accomplished either by locating an efficient collector, preferably wet, at each hood, or by keeping the inside surfaces of all ducts wet and wetting down the contaminant with sprays.

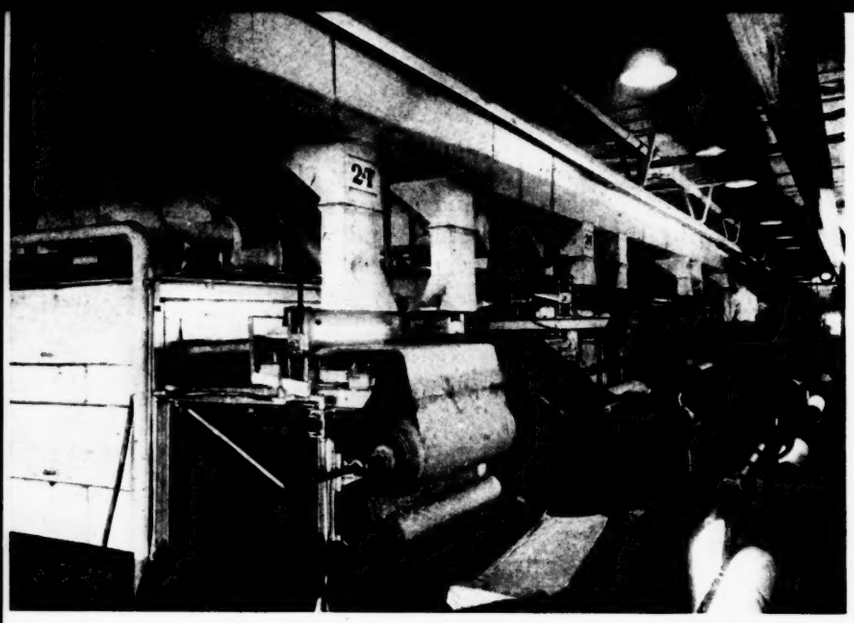
Both systems have been tried and have been found to operate with complete satisfaction. Where systems with collectors have been used, collectors have been located adjacent to the hoods or intake grills so that a large percentage of the contaminant is removed from the air before it enters the ducts or fan. Dry collectors are permitted only where the operation performed at or in the hood is such that a spark or detonation is highly improbable. It must be stressed, of course, that wet collectors are preferred. Dry collectors exist more or less under protest. Where wet collectors are used, the water supply and blower are so inter-connected that the blower cannot be operated unless water is turned on.

In the other type of system which has been found satisfactory, water sprays have been provided in each hood. All ductwork from hoods to the sump, slopes downward so that water from sprays drain to the sump. In addition to sprays in the hoods, there are several sprays located throughout the ductwork to keep the inside surfaces of the duct wet at all times. A water spray is located directly upstream of the fan and directed thereinto to wash the contaminant from the fan blades and housing, and to keep any material collecting inside the fan so wet that it will resist detonation or combustion.

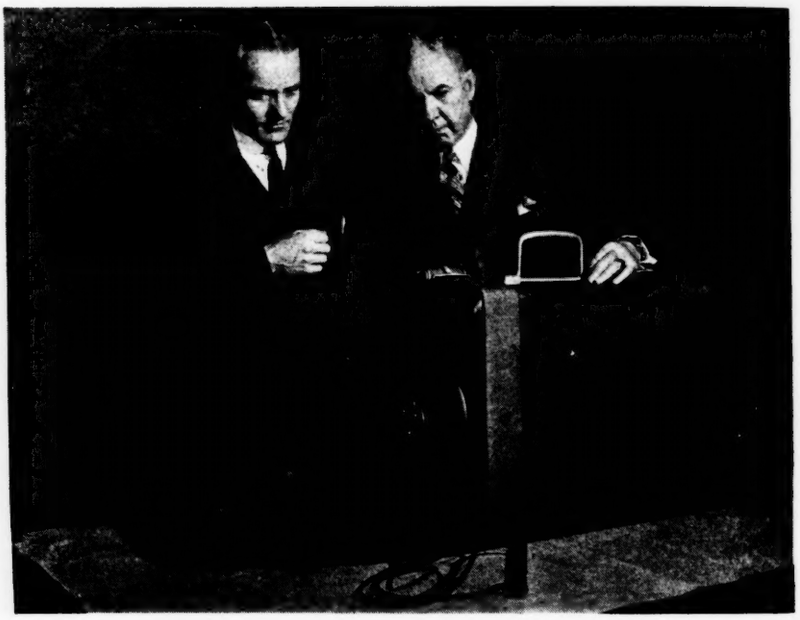
Buildings are generally separated one from the other by considerable distances, and many plants are located in flat, open terrain so that air movement is unobstructed. Consequently, in summer when the doors are open strong breezes through the buildings are the rule. Control velocities must be adequate to overcome interference created by natural air movements. Where the equipment requiring control measures is located near open windows, natural air velocities as high as 1,000 fpm have been experienced on windy days. A minimum control velocity of 350 fpm has been found necessary unless the source of contamination is protected by shields, barricades, or equipment. Individual rooms or bays usually house only a single operation which seldom presents more than two or three major sources of contamination. Consequently, the unit system with hoods and collectors at the several sources of contamination tied to a common exhauster located outside the building provides a satisfactory solution.

Abstract of paper on "Application of Engineering Control Measures in Munitions Plants," by Dr. A. D. Brandt, Sanitary Engineer, U. S. Public Health Service; Safety and Security Branch, U. S. Army. Presented at eighth annual meeting of Industrial Hygiene Foundation held at Mellon Institute, Pittsburgh, November 11, 1943.

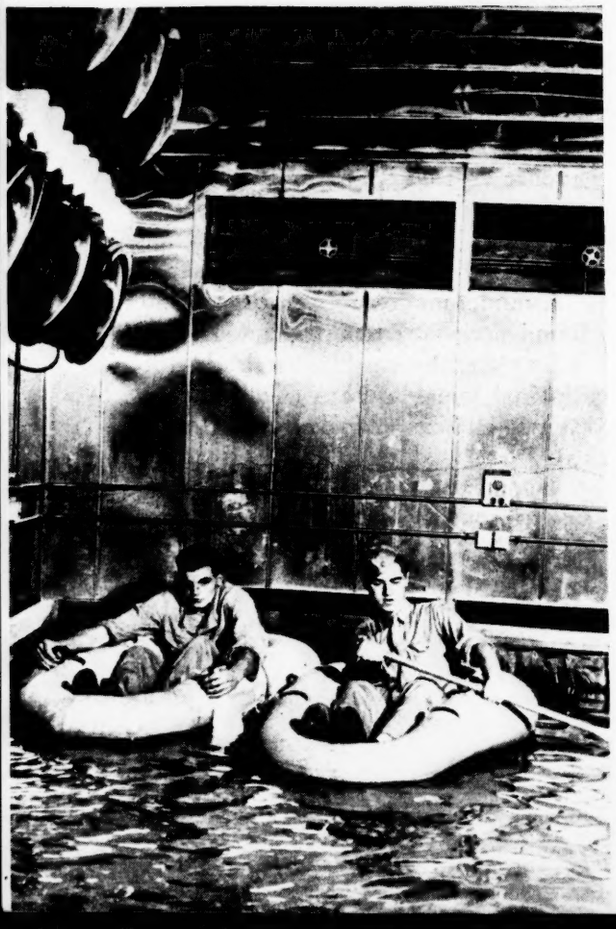
Picture



Ventilation is very important in the manufacture of Neoprene, a synthetic rubber. At the plant of the Firestone Tire & Rubber Company, a pair of ducts are placed over the Neoprene spreader to carry off solvent vapors, thereby reducing hazards to health and dangers resulting from static electricity. Ducts over the knife move 1,000 cfm of air with a resulting face velocity of 500-600 fpm. This arrangement is standard for each of the several spreaders installed. ←



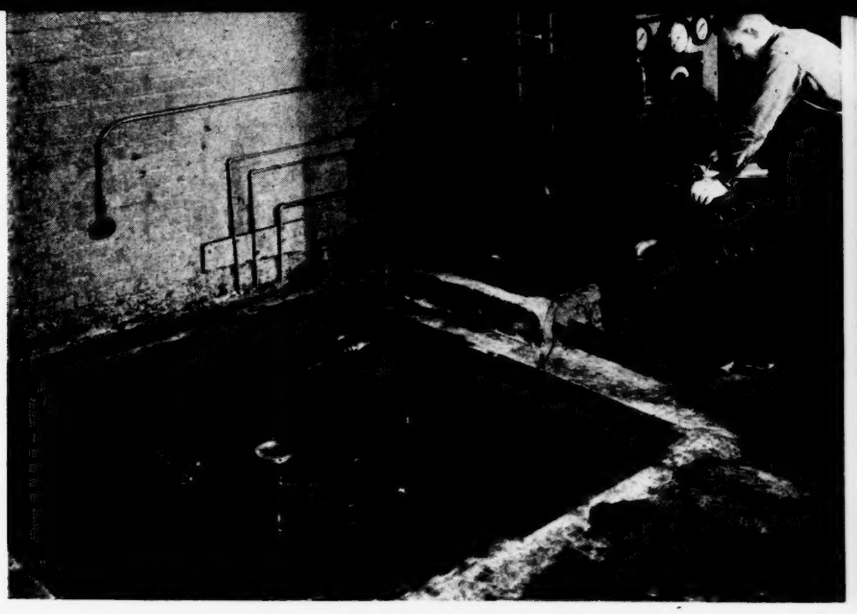
A small portable furnace has been developed for the Army Air Forces by the Norge Division of Borg-Warner Corporation. Weighing only 45 lb, it has operated with good results at 5-mile altitudes and with outside temperatures as low as —70F. The manufacturers believe that the principles of this unit will alter the heating of the post-war home. At left is C. S. Davis, Jr., general manager, and right, M. Glenn O'Harra, vice-president in charge of sales. →



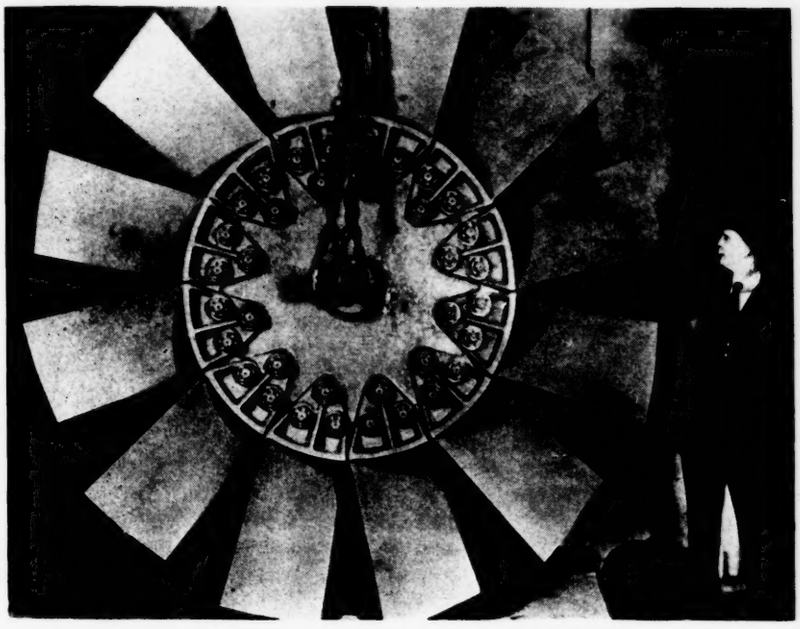
This weather chamber at Wright Field, Dayton, Ohio, is used for testing material and supplies for every type of weather. Temperatures range from —60 to 150F. Hailstorms, rainstorms, sleet and fog can be duplicated. ←

Baseboard radiation has been tested for several years by the Crane Co. Heat is introduced through continuous radiant panels that replace conventional baseboard in the room. It provides more usable wall and floor space.

Paragraphs



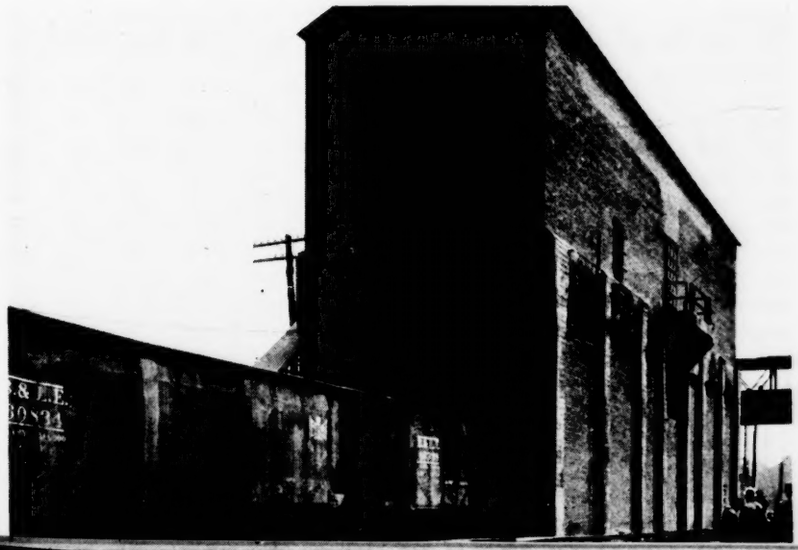
Vacuum test pit in the research laboratory of the Buffalo Forge Company, Buffalo, N. Y., is being used to study stresses in high speed machinery. The pit is 6 ft in diameter and 4 ft deep. The impeller to be tested is hung by a slender shaft from a small air turbine mounted on the cover. Air from the drum is exhausted by a vacuum pump and pressure within the drum may be as low as 0.00787 in. of mercury absolute, requiring power conditions 1/4000 that of normal. ⟶



A stainless steel fan weighing 4,780 lb is used for ventilation at a mine of the International Nickel Company. The mine is so deep that it is not readily accessible for maintenance work. Therefore to eliminate corrosion and reduce wear on this large fan, the metal alloy contained 17% chromium and 12% nickel. Ventilation is necessary in a mine so air may be promptly cleared after each blast. ⟵

Torture oven in the laboratory of the Douglas Fir Plywood Association, Tacoma, Wash. Small specimens are boiled for 4 hours, dried in this oven for 20 hours, and again boiled. While wet, samples are tested to determine the qualities of the adhesive used. ⟶

Ore cars are now thawed by the Carnegie Illinois Steel Corp. Cars containing ore from the Great Lakes are run into this thawing chamber, during the cold season, and then are heated by two oil-fired burners to facilitate dumping of the ore.



Process Piping in Industrial Plants

Concluding Section on Gas Piping

HARRY D. UNWIN
Mechanical Engineer, Albert Kahn Associated Architects & Engineers, Inc.

The calculation of gas distribution problems involving pressures above 1 lb gauge becomes rather involved due to the introduction of the factor (a) for mean line pressure in the formula, equation (2):

$$Q = 4830\left(\frac{Pad^5}{SL\left(1+\frac{3.6}{d}+0.03d\right)}\right)^{1/2}$$

Where P = pressure drop in pounds per sq in.
a = mean line pressure in pounds per sq in. absolute

All other factors bear the same designation and are measured in the same units as for the low pressure formula already discussed.

There have been many formulae advanced for the computation of the quantity of gas flowing through pipe lines when the pressure drop exceeds 1 lb per square inch including those by Cox, Weymouth, Oliphant, Rix, Unwin, Towl, and the so-called Pittsburgh formula, all of which are based upon theoretical analyses and varying methods of determining the friction factor. Tests have proven that the Weymouth formula, although giving calculated results higher than any of the formulae, approaches very close to the actual flow. Lichty, in his book "Measurement, Compression and Transmission of Natural Gas," reports a check made on the Weymouth formula on a pipe line approximately 70 miles long and found that flow determined from the formula was within 0.5 of one per cent of the measured flow.

Table 4 is based upon the Spitzglass formula and represents the "standard flow" (Q_s) for a line 100 feet long (L), a final pressure of 0 absolute (P_2) and a specific gravity of 0.55. The values for Q_s for a pressure drop (P) of 1.00 lb per square inch and above have been increased by the following percentages more nearly to equal those determined by the Weymouth formula:

Pipe dia., in.	1	1¼	1½	2	2½	3	4	6	8	10
Per cent increase	35	27	22	15	11	8	6	1	8	19

If two gas mains are the same size for a given specific gravity gas, then

$$\frac{Q_s}{Q} = \left(\frac{P_s \times a_s \times L \times S}{P \times a \times L_s \times S_s}\right)^{1/2}$$

where subscript (s) denotes so-called "standard conditions" upon which the high pressure flow table is based. Since $L_s = 100$,

$$Q_s = 0.1 \times Q\left(L \times \frac{P_s a_s}{Pa} \times \frac{S}{S_s}\right)^{1/2} \quad \ldots\ldots (4)$$

To find the pipe diameter it is necessary to solve this equation and locate the size of pipe in the table.

Problem: Determine the size of pipe required to pass 70,000 cu ft per hr of gas having a specific gravity of 0.55 when the initial pressure is 20 lb per square inch gauge, the equivalent length is 150 feet, and the allowable pressure drop is 0.8 lb per sq in. per 100 ft.

Solution: The initial pressure P_1 is 20 + 14.7 =

TABLE 4—FLOW OF HIGH PRESSURE GAS
(For line length L of 100 ft; gas with a specific gravity S of 0.55; final pressure P_2 of 0 lb absolute, and with quantities Q in cubic feet per hour at 60F)

Pipe Dia., In.	Pressure Drop, Pounds per Sq. In. (P)																			
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
	Values of $P_s a_s$																			
	1.47	2.96	4.46	5.96	7.48	9.00	10.54	12.08	13.64	15.20	16.78	18.36	19.96	21.56	23.18	24.80	26.44	28.08	29.74	31.40
	Quantity, Cu Ft per Hr.																			
1	415	600	730	840	940	1030	1110	1200	1270	2060	2150	2260	2350	2450	2540	2620	2710	2795	2870	2950
1¼	900	1290	1600	1835	2055	2255	2435	2620	2785	4020	4200	4410	4580	4780	4970	5120	5290	5460	5610	5760
1½	1430	2020	2500	2560	3200	3510	3800	4080	4340	5850	6250	6440	6700	6900	7250	7460	7720	7950	8300	8400
2	2890	4100	5080	5820	6520	7160	7740	8300	8830	10950	11450	12000	12530	13100	13520	13960	14400	14880	15300	15700
2½	4740	6750	8350	9560	10700	11750	12700	13650	14500	17200	18000	18900	19650	20450	21250	21900	22700	23400	24000	24700
3	8620	12250	15180	17420	19430	21350	23100	24800	24600	31300	31600	33100	34500	35800	37300	38300	39400	41000	42100	43300
4	17550	24970	30910	35400	39600	43500	47000	50500	53700	60300	63100	66100	68900	71600	74500	76700	7930	81800	84000	86400
6	53609	76400	94500	108100	121000	133000	143900	154500	164100	175000	183000	192000	200000	208000	216000	223000	230000	238000	244000	251000
8	109500	155800	193000	221000	247000	271500	293500	315000	335000	384000	401000	421000	439000	456000	475000	489000	505000	521000	537000	551000
10	176000	250000	310000	355000	397000	436000	471000	506000	538000	700000	732000	766000	802000	833000	865000	893000	920000	950000	976000	1003000

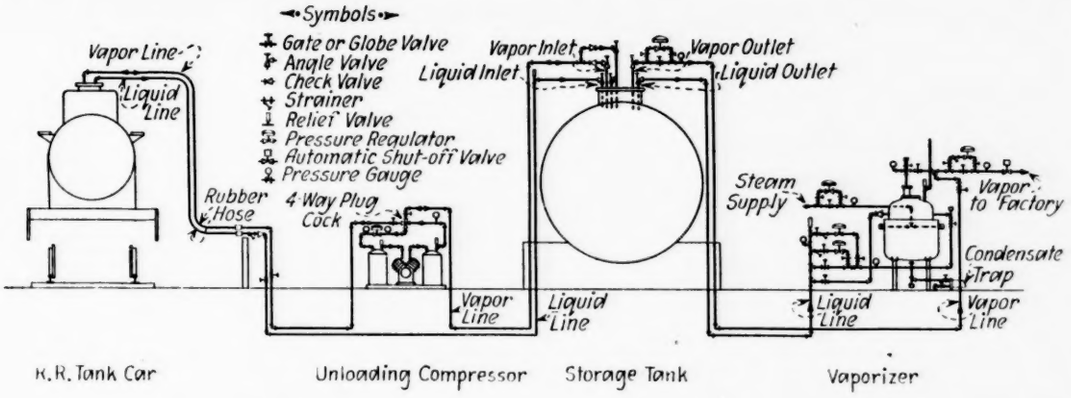


Fig. 3. Schematic diagram of a liquefied petroleum system.

34.7 lb per sq in. absolute. The pressure drop $P = 0.8 \times \frac{150}{100} = 1.2$ lb per sq in. The terminal pressure P_2 is then $(20 - 1.2) + 14.7 = 33.5$ lb per sq in. absolute. The mean pressure a is $\frac{34.7 + 33.5}{2} = 34.1$ lb per sq in., and $Pa = 1.2 \times 34.1 = 40.9$ lb per sq in. P_s a_s for $P = 1.2$ is found from Table 4 to be 18.36. Substituting in equation (4),

$$Q_s = 0.1 \times 70{,}000 \left(150 \times \frac{18.36}{40.9} \times \frac{0.55}{0.55}\right)^{\frac{1}{2}}$$

$$= 57{,}400 \text{ cu ft per hr}$$

Under $P = 1.2$ in Table 4, find 66,100 as the nearest layer Q to 57,400, and opposite 4 in. pipe. This is the required diameter.

Since the table has been computed for pressure drops from 0.1 to 2.0 lbs the final pressure (P_2) determined from the assumed pressure drop can be taken as the initial pressure for the next section of main or branch. The error introduced by not recalculating the actual pressure drop for the size of pipe selected is not serious under the fluctuating operating conditions which exist in the industrial plants.

Referring to the example of low pressure distribution in the aluminum foundry, if high pressure gas at 20 lb gauge had been available, it can be shown that the 8 in. diameter pipe for section A-A_1 could be reduced to 4 in.

It is important to know when to apply the low and when the high pressure formulas. The pressure drop is the determining factor in this respect. When it is less than one pound, the low pressure formula is easier to apply and is therefore preferred, although the high pressure formula will give comparable results.

Liquefied Petroleum Systems

There are several liquefied petroleum gases which are used for fuel such as propane, butane and pentane, of which, propane and butane are the most common. These gases are obtained from natural gas, oil and various refinery processes. They have the following characteristics:

	Propane	Butane
Specific gravity of liquid at 60F (water = 1)..	0.509	0.576
Initial boiling point at atmos. pressure, F	—51	15
Weight per gal of liquid at 60F, lb	4.24	4.84
Vapor pressure, lb per sq in. at 100F	195	65
Cubic feet of gas per gallon	36	32
Total heating value of vapor, Btu per cu ft	2,550	3,200
Total heating value, vapor, Btu per lb	21,650	21,500
Total heating value, vapor, Btu, per gal	91,800	102,400
Specific gravity of gas (air = 1)	1.52	2.00

Propane and butane gas are heavier than air and are practically colorless and odorless; consequently, agents are added at the source to provide a distinct odor to the gas to warn against leakage.

In general, propane and butane systems are quite similar and consist essentially of storage tanks for liquefied gases, vaporizing equipment and unloading facilities which may be either pumps or compressors. In addition, mixing valves are often used to mix air and gas (propane or butane) together to produce a gas-air mixture of similar burning qualities to natural or manufactured gas. If the factory distribution system is high pressure, a compressor is also required to boost the gas-air mixture to the desired pressure.

There is a wide variety of combinations and sizes of equipment, the selection of which depends upon the particular requirements of the system. It is strongly recommended that plant engineers consult their insurance representative concerning the design of any proposed system because of the hazards involved; and in addition submit their requirements to an experienced organization that specializes in the design and installation of this type of equipment. Fig. 3 is a schematic diagram representing a high pressure propane vapor system similar to the Phillips Petroleum Company system, which illustrates one method of connecting the equipment. If a propane-air mixture is required, a diluter compressor would be connected between the vapor regulator and the automatic safety shut-off valve.

Liquefied petroleum gases are transported in the liquid state under pressure in tank cars or tank trucks. The unloading of the fuel into either above-ground or below-ground storage tanks is usually done by pumping or the differential pressure method. Steam or electric driven reciprocating or rotary type

pumps may be used. The differential pressure required to transfer the liquid from the tank car to storage need not exceed 10 lb per sq in. Although compressed air can be used, it is common practice to use a booster compressor to increase the pressure of the vapor drawn from the storage tank. This is introduced into the tank car above the liquid level, thus producing a pressure in the tank car higher than the pressure existing in the storage tank and causing the liquid to flow out the unloading pipe in the tank car manhole. The unloading connections at the compressor are arranged so that, when the tank car has been emptied of all liquid, a four-way cock can be reversed and the vapors, at high pressure remaining in the tank car, can be recovered. The maximum pressure required to unload cars is approximately 75 lb per sq in. and 200 lb per sq in. gage for butane and propane respectively. Another method sometimes used to unload liquefied petroleum tank cars is to lower the pressure on the liquid in the storage tanks below the existing vapor pressure in the tank car. This is accomplished by passing cold water through coils installed for this purpose in the storage tank; or by using vapor from the storage tank and making use of the latent heat of vaporization.

All storage tanks for liquid, vapor, or gas-air mixtures should be constructed in accordance with the ASME Code for Unfired Pressure Vessels, but under certain conditions may be constructed according to the API-ASME Code which provides for a smaller factor of safety. The size and number of storage tanks depends upon the maximum system demand and the desired minimum inventory to be maintained. It is customary to install tanks above-ground, although it is permissible and sometimes desirable to bury the tanks. When tanks are installed below ground, they should preferably be below the frost line, but in all cases should have a minimum of 2 ft cover. They should be set on a firm foundation and backfilled with soft earth and sand, well-tamped in place. Under-ground tanks should be adequately corrosion-proofed by painting with a heavy coat of coal tar or asphalt mastic and carefully wrapped with burlap or felt paper before installation. Above-ground tanks require only two supporting concrete piers with the centerline of each pier located approximately 12 in. from the tangential ends of the tank. Above-ground tanks must be grounded to avoid the hazard due to static electrical charges.

Storage tanks are rated on their "water capacity"; that is, on the number of gallons of water they will hold. The National Board of Fire Underwriters have established so-called minimum "filling densities" which are defined as the per cent ratio of the weight of the gas in the tank to the weight of water the tank will hold at 60F. For propane, having a specific gravity of the liquid of 0.509, the "filling density" is 42%. Assuming a tank has a water capacity of 30,000 gallons, then the maximum quantity of propane permitted will be

$30{,}000 \times 8.3 \times 42\% \div 4.24 = 25{,}000$ gal. (approx.)

This reduced propane capacity must always be considered when determining the storage requirements of the system. For a given specific gravity, the filling density for underground tanks is slightly higher than for above-ground tanks.

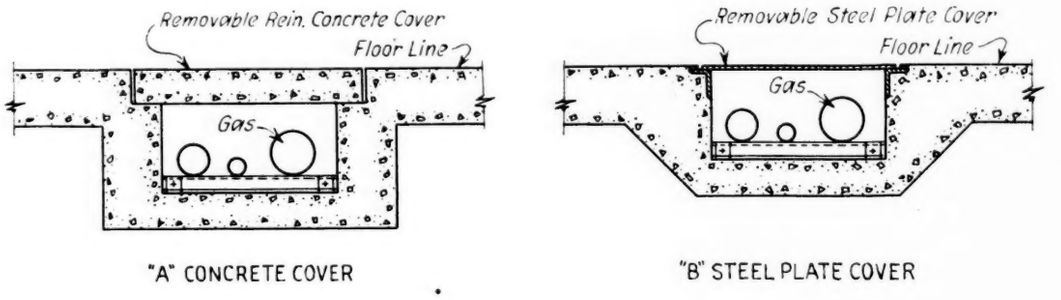


Fig. 4. Typical floor trenches showing removable covers.

In smaller installations, and frequently in large jobs, during summer months particularly, when storage tanks are above ground, it is possible to distribute propane or butane vapor direct from the storage tanks to the factory system or to a diluter by means of their vapor pressure. Ordinarily the fuels are discharged as liquids from storage to steam or hot water heated vaporizers which supply the necessary latent heat of vaporization. These heat exchangers may be of the multitubular type or pot type. The multitubular units consist of a vertical bundle of tubes enclosed in a steel shell and so connected that the propane or butane liquid enters at the bottom and passes around the tubes. The heating medium—steam or hot water—enters the tubes at the top so that the full efficiency of counter-flow can be utilized. The pot type heat exchanger consists of a jacketed tank as indicated in Fig. 3 and has the vapor outlet on top.

The steam or hot water is usually taken from the factory systems, but in cases where neither are available, a propane or butane gas-fired automatic hot water boiler is installed in the vaporizer house in a separate room completely isolated from the vaporizer room. There is usually sufficient vapor pressure in the storage tank to deliver propane gas to the burners for starting the system after a shutdown.

Liquefied petroleum systems in general and propane systems in particular must be adequately pro-

tected by means of regulators, excess flow valves, and relief valves, because of the extreme volatility of the fuel and the pressures under which the liquid is handled. Each storage tank must be equipped with liquid level gauges to show the maximum liquid filling heights for various temperatures as established by the NBFU standards. These gauges may be of several types such as slip-tube, rotary or magnetic gauges. Excess flow valves are usually provided inside the tank on all outlets to shut off the gas or liquid if the allowable flow through the valve is exceeded. At least one, and generally two, relief valves are provided on each storage tank and arranged to permit free flow to the atmosphere if 150% of the design pressure of the tank is exceeded. Each relief valve discharges into a vent pipe terminating in a rain cap at a point 10 feet or more above the storage tank.

Duplicate pressure regulating valves are installed in parallel near the vapor outlet of the storage tank. Where the storage facilities consist of several tanks, this primary regulator station is installed on the vapor outlet header for the several tanks and need not be provided for each tank. This vapor line is not used on undiluted high pressure distributing systems except when unloading tank cars. It may be used, however, for direct delivery of vapor to the factory whenever the vapor pressure in the storage tanks is sufficient to supply the required demand, such as during shut-down periods or periods of light demand as over week-ends. Butane vapor is seldom taken direct from storage tanks because of its low vapor pressure. At other times, liquid propane is withdrawn from storage and passed through connecting piping and regulators to the vaporizers. After vaporization, the liquefied petroleum gas (Fig. 3) is passed through final pressure regulators into the factory distribution system as undiluted propane gas. The vaporizers and all regulators should be vented to the atmosphere. To further protect the vaporizing system and prevent the liquid from entering the factory distribution system, a float controlled condensate trap is employed on the outlet of the vaporizer. If for any reason liquid should reach the heat exchanger outlet, the level in the trap rises closing the inlet valve and preventing liquid flow beyond it. Normally, vaporized propane flows through the float controlled trap directly into the distributing main after passing through two stages of pressure reduction.

Liquefied petroleum storage and vaporizing systems should be located beyond important buildings, and this distance should be at least 75 feet where individual storage tanks have a water capacity of more than 1200 gallons. Because of the extreme volatility of the liquids, it is not common practice to erect dikes around above-ground storage tanks. Under exceptional conditions if the slope of the ground is excessive, dikes may be justified if adjacent buildings or property would be damaged by the rupture of a storage tank. All electrical equipment including motors, starters and switches must be of explosion-proof construction in accordance with the standards of the National Electrical Code for Class I Group D locations.

Materials and Installation

For practically all commercial fuel gases, wrought iron or steel pipe of standard weight may be used when the pressure does not exceed 125 lb per sq in. Malleable iron or welded fittings are preferred for gas piping; cast iron fittings are not recommended. All propane liquid lines between storage tanks and vaporizers should be extra heavy steel pipe and fittings. It is good practice to weld all joints on lines 2½ in. diameter and larger whether located overhead or buried. Under certain conditions it is desirable to use welded joints on the smaller size pipe lines.

At connections to mains and branches to all equipment, shut-off cocks or valves should be installed so that each branch and each piece of equipment can be independently isolated. This is particularly important on new installations because it is often necessary to start-up one or more units prior to completion of all branch lines to equipment. Gas cocks or packless valves are preferred to gate valves or globe valves on low pressure lines because they are less likely to leak.

It is important to install pipe mains in locations where there will be a minimum chance of mechanical injury. This is particularly true for gas and hazardous liquid lines. They must always be well-supported and in some instances expansion must be considered. Due to the fact that some types of gas may contain moisture, it is always desirable to provide a drip pocket at all low points in the piping system. Gas piping should not be installed in tunnels or under-floor trenches where it can be avoided. When it is necessary to install such piping in confined locations, adequate ventilation must be provided. Fig. 4 illustrates two types of floor trenches with removable covers. A good plan where trenches are necessary is to drop into trenches at columns from overhead mains and install shut-off cocks at columns and at furnaces. By providing perforated plate covers over curbed openings at both ends of the trench sufficient ventilation will exist to prevent accumulation of gas. On the other hand, piping carrying liquefied petroleum gases should never be installed in trenches unless they are enclosed completely in a second pipe which is vented to the atmosphere outside of the building since these gases are heavier than air and will settle in any open pit or trench.

Safety Precautions

Installation of any inflammable gas system requires that the utmost care be exercised in regard to fire hazards and that every precaution be taken to make the installation a safe installation. Much can often be gained by submitting the piping plans

to the insurance company for comments since they are familiar with such installations and the causes of many costly fires. A few of the many safeguards that are considered good practice follow, with several being illustrated in Fig. 5:

(1) On high pressure gas distribution systems install a three-way cock on the supply to each furnace in addition to the usual shut-off cock. This cock should have a 2-ported plug and connect so as to either pass gas to the furnace or, when turned 90

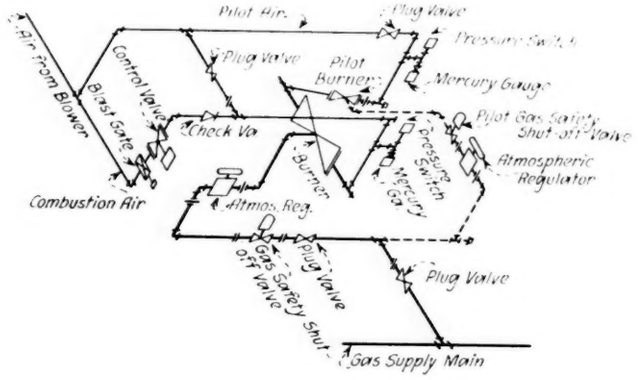


Fig. 5. Diagram of burner piping showing safety control.

degrees, shut off the supply and vent the furnace to the atmosphere. Usually a ¾ in. vent line is sufficient. It should terminate above the roof of the building in a screened outlet.

(2) Many low pressure gas burners require combustion air be delivered to the burners at 12 to 20 oz. A pressure switch is often installed in the air supply line and connected electrically to a solenoid operated valve in the gas supply so that this valve will close if the air supply should fail.

(3) To protect the system against failure of the gas supply, a solenoid operated shut-off valve is installed in the gas distribution main. This valve is controlled by a pressure switch set to close when the gas pressure drops to a point which would cause the burner to go out. Provision must be made to prevent gas from entering the furnace after such failure of the supply until the operator has had an opportunity to purge the furnace and is ready to relight the burner.

(4) Similar safety measures should be taken in regard to all pilot burners. If automatic shut-off controls are not installed, the return of pressure on the system, after a failure of the gas supply, may result in the filling of the furnace with unburned gas. This would be very serious and the hazard of an explosion is apparent.

(5) Whenever a pressure regulator is required, particularly on high pressure gas, the air space of the regulator diaphragm housing should be vented outdoors to prevent accumulation of gas if the diaphragm fails, or leakage occurs.

(6) When a pre-mixing gas-air blower is used a solenoid operated valve must be installed in the gas supply line and connected to the motor starting circuit so that it will close in case of power failure. This valve should be of the type that requires manual resetting before it will open after closing due to current interruption.

(7) The installation of safety shut-off valves on liquefied petroleum gas lines is of equal importance. It is not uncommon to provide an excess pressure shut-off in the line leaving the vaporizer house and a low pressure (pressure failure) shut-off as the delivery line enters the factory. These valves may be of the diaphragm type with weighted levers arranged so that after acting they must be manually reset before normal operation can be restored.

(8) It is poor practice for a gas line to enter or leave a building below the floor line. When a pit is desired for a drip pocket, it should preferably be located outside the building wall, and, even then, should be filled with sand. Suitable means can be provided for discharging moisture from the drip pocket by operating valves above the floor line.

Maintenance Requirements

A well-designed and installed piping system should require very little maintenance; nevertheless, all regulators, control valves and burner piping should be accessibly located for the convenience of the operator. Each pressure regulator should have provided a three valve by-pass, unions on both sides of regulator and a high and low pressure gauge.

Propane has a tendency to leak through closed valves and fittings which might otherwise be tight for natural or manufactured gas. It is recommended that all screwed joints be made tight with litharge and glycerine. Where cocks are used, it is suggested that they be of the lubricated plug cock type provided with a lubricant specially suited for the service intended.

Where safety shut-off valves are employed, suitable valving should be installed and provision made periodically to force the safety valve to function to insure it being in working order at all times. These valves are emergency valves; their operation being required only at infrequent intervals, if at all. For this reason, it is vitally important to know they are really guardians against loss and not merely piping ornaments.

In conclusion, it should be emphasized that three main points are essential for a satisfactory gas piping system: (1) the minimum initial pressure must be positively ascertained; (2) the sizing of lines must be determined with care after considering the several variables involved; and (3) adequate safety devices should be provided.

As mentioned in the first part of this article, process piping in industrial plants has not always received its proportionate share of attention. Occasionally the production service piping is the last phase of the construction program to be installed and the location of mains and branches has been given the millwrights and steamfitters on rough sketches indicating a lack of appreciation of the importance of such work.

(The next article of this series will cover fuel oil and quench oil piping.)

Air Conditioning by Gas

Field Findings of a Number of Existing Gas Operated Installations – Part 2

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QUITE early in the development of residential air conditioning, sales engineers began to encounter the irregularities in seasonal amount of equipment operation and energy consumption already commented upon. (See July issue, page 81.) Forecasts of operating expense for prospective owners did not prove dependable, and estimates of energy sales to be derived from a given amount of installed capacity sometimes were noticeably inaccurate. To discover the factors involved, inquiries were made into the circumstances of "exceptional" cases, and the following explanations were brought to light.

Adequacy of indoor conditions maintained, i.e., closeness of approach to ideal
General reaction of owner, and likes or dislikes of any critical members of family
Personal susceptibility to colds, allergic pollens, high temperature or humidity, apparatus noise, slight drafts
Severe or protracted illness in family
Vacations spent away from home
Week-end absences at country home, golf club, or on automobile trips
Amount of entertaining done during evenings or at weekends
Ownership of valuable furnishings, art works, books, etc., affected by high humidity or mildew
Willingness of owner to incur expense for operation, on borderline days or at night
Dependability of equipment, i.e., duration of shutdowns caused by any defects and repairs.

There are, in addition, the known elements entering into determination of peak cooling load and selection of unit with suitable capacity rating, as listed below.

Local climate, as to extreme and average temperature and humidity, amount of sunshine, length of cooling season
Actual cooling load, determined by:
Size of building
Type of construction
Extent of thermal insulation
Exposure to direct sun, i.e., shading by trees or adjoining buildings
Portion of house served, i.e., entire or partial with switch-over damper
Amount of outdoor air-supply desired.

Since variables in first group are not always predictable, it has seemed unwise for utility-company representatives or equipment salesmen to state the probable seasonal operating expense. Instead, the preferred method is to give hourly full-load cost, and to let the prospect suggest his own figure for seasonal operating hours.

Forecast of energy sales and revenues for groups of installations, say 100 or 1000 or more, should be obtainable in the future with reasonable accuracy, if statistics are assembled and properly analysed along the lines discussed.

Future Load Factors

However, there is possibility that some new factors now in development stage may affect future loads and consumptions; these include such items as:

(a) Adoption of reheat for fuller control of humidity, in localities having high outdoor humidity without extreme temperature, and for applications where internal sensible heat load is low.
(b) Provision of fans giving greater air volume and static pressure
(c) Introduction of 24-hour operation in extreme weather, permitting use of smaller air-conditioning unit
(d) Substitution of fluorescent lighting with reduction of wattage, if illumination intensity is not raised substantially
(e) Reduction in outdoor quantity, made possible by use of deodorants and germicidal lamps
(f) Greater use of thermal insulation with very low transmission factors, such as foam-type glass, rubber and plastics
(g) Use of Thermopane multi-laminar sealed glass construction for windows.

These are applicable to existing buildings, if modernized, as well as to new construction of either conventional or prefabricated types, and may come along rapidly after the war.

Trend of Equipment Use Factor

Extent to which air-conditioning systems are used, as time goes on and owners become acquainted with benefits, limitations and operating costs of the apparatus, is of definite concern to the gas industry. If amount of operation increases substantially during the second year, and holds steady or increases still further in third and subsequent years, this is definite evidence of favorable opinion on value of the service and on operating expense. On the other hand, de-

From a paper presented March, 1944, at Rochester, N. Y., meeting of the American Gas Association for inclusion in a report to be issued by the Joint Committee on Gas Summer Air Conditioning.

cline in extent of use, and in gas and electric consumptions would call for close investigation of local circumstances and taking effective action to remedy any deficiencies found, or to lower the operating costs. Equipment manufacturers and installation contractors are concerned mainly with use trends in so far as they influence the future market; utility companies are more vitally affected, because revenues from the load constitute their sole interest in promoting air-conditioning business.

Investigation of use trend has not yet received the attention it deserves from the industry as a whole. Admittedly it is difficult, because of complicating factors such as year-to-year climatic variations, changes in users' requirements, and alterations made in buildings or in the equipment. Variation of 20% in degree-day heating load and 40% in seasonal cooling and dehumidification demand for successive years is not uncommon; however, consumption records can be adjusted accurately enough to eliminate these variables. The troublesome elements are those relating to occupancy, structure and appliance —both difficult to correlate with air-conditioning energy use. Separate meters would help; however, the recent tendency has been to remove those meters which were provided, because of wartime materials shortage.

In most cases, estimates of consumption chargeable to air conditioning must be derived from customer records for the year "before installation", which become less trustworthy as time passes; their usefulness will decrease still further after the war, when wornout appliances and obsolete lighting systems are replaced with new types.

Consumption Trend

An analysis to determine consumption trend has been made by New Orleans Public Service, for 5 residential and 5 commercial customers with Servel Model CHA units; in each group, 1 unit is 3-ton and remainder are 5-ton. Climatic conditions for the 2 years are:

	1942	1943	Change, Per Cent
Cooling, degree-hours excess, 85F base	2,602	3,298	27 increase
Heating, degree-days deficiency, 65F base	1,357	1,164	14 decrease

Estimated energy consumptions for the 2 groups of air-conditioning customers are shown, with second year's values adjusted by multipliers which are the ratios of degree-days and of degree-hours.

	As Reported				1943 Adjusted		Change,	
	Gas Mcf		Elec. Kwh		to 1942 Basis		Per Cent	
	1942	1943	1942	1943	Gas	Elec	Gas	Elec
Residential, without tower								
Cooling	122.6	173.1	1092	1424	136.5	1127	11 incr	3 incr
Heating	91.3	79.0	700	568	91.8	651	1 incr	7 decr
Residential, with tower								
Cooling	119.3	174.3	3430	4870	137.5	3840	15 incr	12 incr
Heating	91.3	79.0	700	568	91.8	651	1 incr	7 decr
Commercial, without tower								
Cooling	99.6	118.1	907	1137	93.5	898	6 decr	1 decr
Heating	49.5	48.4	320	394	56.3	458	14 incr	43 incr

There is noticeable increase in second-year use for cooling, by residential customers, but decrease is shown in the case of commercial customers. For heating, trend appears to be reversed. Agreement between gas and electric consumption trends is not close; last-line entries for commercial heating indicate 3 times as much increase in electric consumption as in gas.

Further work along these lines, to devise simple and dependable methods for detecting use trends, appears desirable as a future Committee activity.

Servicing Experience

In the interim since field data on servicing problems and customer satisfaction, derived from 1942-1943 operating experience, were submitted to the Committee, comprehensive analyses of service causes, methods and expense have been prepared by the utility companies having majority of gas-air-conditioning installations in their territory. The studies include classification of service calls, man-hours time spent, materials used, hourly cost per call, transportation expense, and allocation of costs between utility, manufacturer and customer. These show a changing picture. Modernization of early models, progressive elimination of inadequate or defective parts, greater skill acquired by service mechanics—all have tended to reduce the frequency of routine and emergency calls. Equally important is the experience gained by owners as to how the equipment behaves under normal conditions; this has decreased substantially the number of calls "without cause".

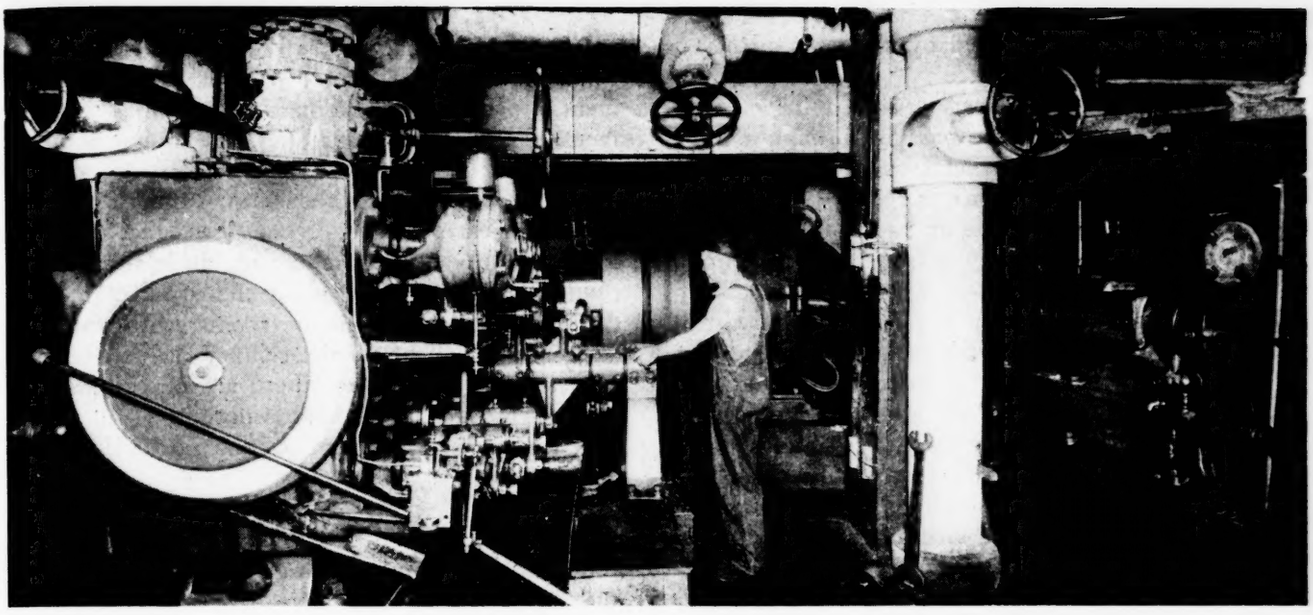
Among outstanding problems, those of water treatment to prevent scaling and corrosion of cooling towers, heat transfer devices and steam generators require the largest amount of work still to be done. Supplementing the detailed studies along these lines, which equipment manufacturers now have under way, AGA Laboratories is starting a general survey of field conditions and requirements. Troubles from unsuitable water have confronted the entire air conditioning industry since its inception.

Customer Satisfaction

Only 23 of the 93 installations covered by field reports included statements as to degree of satisfaction expressed by owners. Opinion is classified as follows: Excellent 18, good 1, fair 3, poor 1. The survey results are supported by more complete canvass of air-conditioning users completed by one utility company; in more than 90% of cases, opinion given was excellent or good.

Brazil Increases Coal Output

Production of coal in Brazil, stimulated by loss of European and U. S. imports, has increased from 900,000 tons in 1938 to 2,500,000 tons in 1943. The whole output in 1943 was estimated at $7,200,000.00.



Fuel Savings by Means of Air Recovery

T. W. REYNOLDS

WHAT is meant by air recovery?

Normally, we think of air recovery as used air which together with its heat or cold content would be exhausted to outdoors, were it not returned for recirculation after losing some objectionable qualities. The combination of equipment used may include electrostatic air cleaners, gas and odor adsorbers, and cyclone or dynamic precipitators with filter arrestors.

Air recovery is necessary in many cases only for reasons of economy. Primarily it is desirable due to eliminating a nuisance from contaminated air, and also because increase in recirculation of the air and improved sanitation of that air improves employees' working conditions and health. Health has economic significance, whether in home, office or factory, and any improvement in health shows direct results through reduction of lost time and increased working efficiency. Air recovery should also be credited with a reduction in fuel, transportation, and manpower requirements. Load reduction also allows the overloaded boilers to be operated at a more efficient point and with less maintenance.

We are concerned only with air recovery as it affects fuel conservation. Air recovery, therefore, is not limited to recirculation and purification of air, but branches out to include any other method by which the make-up air may be reduced in volume and temperature and made to serve as a fuel saver.

Obviously, recirculation of air avoids the introduction of a corresponding amount of make-up air, cold in the heating season and hot in the cooling season. Fuel is saved if there is less air to be moved and if there is less air to be passed through and against the resistance of pre-heat and other coils, as well as an outdoor air intake filter. Horsepower requirements are also reduced on the refrigeration side. Even where water comes to the condenser under its own pressure, there is no doubt a pump with motor somewhere along the line to give the water that pressure. To all this must be added the most obvious of fuel savings as obtained by less cold make-up air to heat in the heating season.

It has been frequently said that there is no saving in the amount of air to be moved by reducing the amount of make-up air, as any such reduction merely transfers a like amount of air to the return side of a fan. This is true as long as the quantity of air exhausted remains unchanged, for the total air volume handled by the supply fan must remain unchanged, being fixed by the total heat differential between supply air and room air.

Sometimes, however, the volume of air exhausted is so vast that the total air requirements become fixed by the outdoor make-up-air needs and there is then no return air. In such a case, any exhaust air reduction will effect an equal reduction in the make-up air and constitute a saving in fan energy for supply and exhaust, in addition to the saving by eliminating the heating of make-up air. Air recovery has then been obtained in so far as fuel conservation is concerned. If the reduction in the amount of exhaust air is continued to the point where the outdoor make-up air is less than the total air required by the allowable temperature differential, then the difference can come back as return air. In this event, true

air recovery may be obtained by some air purification device.

As a rule, the return air is arranged for mixing with the make-up air before passing through a pre-heat coil, so that the friction from the coil is the same whether the make-up air is reduced in amount or not. But if the return air by-passes the pre-heat coil, then there is an energy saving by a reduction in the amount of make-up air.

In some cases the energy required for increased recirculation of air against the resistance of the return ducts may be greater than if a like amount were drawn in through the outdoor air intake. On the other hand, if there are no return ducts, as is often the case, it may take less energy to recirculate air than to draw air from outdoors. Another point is that any reduction in the amount of make-up air cuts down on the friction through the outdoor air intake filter. Energy is then saved, providing the return air is not filtered or passed through an air recovery unit of substantial resistance.

Ventilation by Exhaust Fans

It should be kept in mind that there are many installations which are not air conditioned and where the only ventilation is by exhaust fans. The make-up air in such cases may come through opened doors during the summer months and by general infiltration in the winter months, where the make-up air is not great enough to cause discomfort because of cold drafts. Any reduction in the amount of exhaust air will then save fan energy and also on useful heat, unless the make-up air is drawn from some nearby overheated department. If this exhaust fan is supplemented by a supply fan and heating coil, there will be a reduction in make-up air and additional savings in power otherwise required for supply fan with its filter and coil.

Equipment developing heat, gases, smoke, or fumes, when segregated or located in partitioned-off spaces will greatly reduce exhaust and make-up air ventilation requirements. Process equipment requiring exhaust, when reasonably sectionalized for economy of partial usage, will likewise save on energy and fuel, as all machines, fans, or ducts, need not be in operation when only a part of the equipment is producing. All equipment requiring exhaust should be hooded and closely so in order to move as little air as possible. All this is in effect "air recovery" in so far as conservation of fuel is concerned.

Exhaust air in some cases can be discharged directly into some high or remote point of an industrial space from whence it can be diffused and make-up air provide for the air exhausted from such space. Upon occasion, it can even be discharged close to the hoods of ventilated equipment. Cafeteria air, for example, or even kitchen air, is often less objectionable than the air in industrial spaces and not noticeable when mixed with such air. In many cases air from toilet, shower, locker, wash and rest rooms has been discharged into vast industrial spaces common today, especially so as the amount of industrial exhaust is so great due to present process requirements, speed of production, and crowding of equipment, that air from the toilet and similar rooms is readily diffused.

Such ventilation methods are justifiable, at least under present emergency conditions, and should be accepted in view of the change in manufacturing conditions, as cited. In many industrial plants, one can find toilets and similar rooms, with partitions terminating well below the ceiling, and still hear no criticism, merely because there are no exhaust fans from such spaces; yet there is nothing at all to prevent the vitiated air from passing into adjacent industrial areas.

Air recovery or fuel saving can sometimes be accomplished by introducing cold make-up air without any heating by adding it at some high overheated level, or by bringing it down to work levels around some waste heat stack so the air can be heated on the way. There are also some cases where cold air may be introduced in overheated spaces, or close to the exhaust of hot machines, without passing the air over any occupants.

How Much Fuel Can Be Saved By Air Recovery

Energy and fuel savings in industrial plants are far greater than the average engineer realizes. Let us see what they are per each 1,000 cfm of air recovered in a locality such as New York City.

Assume outdoor design conditions, for the heating season, db 0F, and as the air is probably near saturation at this low temperature, say 75% rh, with a total heat of 0.66 Btu, and for the cooling season, db 95F, wb 75, or total heat of 38.46 Btu.

Assume indoor design conditions, for the heating season, conditioned at db 70F 40% rh and total heat of 23.66 Btu, and for the cooling season about 67 db, or total heat of 31.46 Btu.

The saving in capacity of installed conditioning equipment for a reduction of 1,000 cfm in outdoor air make-up will then be for heating.

$$\frac{1000 \text{ cfm} \times 60 \times (23.66 - 0.66)}{13.3 \text{ S.V. Standard Air}} = 103{,}761 \text{ Btu}$$

per hour, or 103,761 ÷ 334,575 = 3.1 boiler horse power.

For cooling,

$$\frac{1000 \text{ cfm} \times 60 \times (38.46 - 31.46)}{13.3 \text{ S.V. Standard Air} \times 12{,}000 \text{ Btu}} = 2.63 \text{ tons}$$

of installed refrigeration. The kw capacity reduction back in the power house will be 2.6 kw, based on one kw per ton of refrigeration.

The saving in fuel for the heating season will be

$$\frac{\begin{matrix}103{,}761 \text{ Btu per hour design day} \times 24 \text{ hours} \\ \times 5306 \text{ degree days}\end{matrix}}{\begin{matrix}(65° - 0°) \times 75\% \times 12{,}500 \text{ Btu coal} \\ \times 2{,}000 \text{ lbs. per ton}\end{matrix}} =$$

10.8 tons of coal. Note, 24 hrs. is based on current war production plant operation.

Saving in cooling energy per cooling season will be

1,000 cfm × 60 minutes × 1,500 operating hours × (38.46 — 31.46) × 60% design load × 0.75 kw input per ton refrigeration ÷ (13.3 S.V. Standard Air × 12,000 Btu per ton) = 1,670 kw hours.

Note, 16 operating hours per day is assumed based on current war production plant operation; 24 hour operation is often required in order to maintain precision of product, otherwise 16 hours as lag would not be great for the slight differential.

Not all war plants are conditioned, in which case the indoor design conditions would be about the same as outdoors, so that we should probably assume 20% relative humidity for such plants, instead of 40%. In this case the dry bulb temperature would have to be raised from 70F to 73F, in order to obtain the same comfort, but the total heat differential would decrease from 23 to 21.3 Btu in spite of the dry bulb rise. The reduction in fuel tonnage per heating season would then be 10 tons instead of 10.8 tons, and the boiler hp capacity reduction would be 2.9 instead of 3.1. If effective comfort lines were parallel to wet bulb lines there would be no change.

It has been said that heating in war time plants is frequently unnecessary above 50F outdoor temperature, due to process heat and windowless buildings. Air recovery, it was stated, should therefore not be credited with any fuel saving above 50F outdoor temperature. However, any reduction made for this condition would be very small, less than 2%, as the only change in the total heat differential (23.00) between that of outdoors would be merely (0.36) that due to the sensible heat change in a dry bulb decrease of 20F. There is a substantial fuel saving, of course, in any building where heating is not required until the outdoor temperature lowers to 50F, as the saving is applied to all the heat losses of the building. In the present case, however, we are dealing only with the heat losses in the air.

In any event, there are a few cases where even this small saving of 2% could not be made, regardless of whether heating was necessary at 50F or below for the outdoor temperature. This would be the case where there is a large unrecoverable exhaust. In such a case the mixture of the small amount of return air and the large amount of outdoor air would be too low in temperature for introduction into the building without heating to about 60F.

Normally, the per cent of outdoor air that can be taken as a minimum during the winter is rather low, usually less than 25%, so that the mixture of outdoor and return air usually approaches around 60F. No heating is then required as the internal heat load is great enough to heat the incoming air from 60F to the desired room temperature.

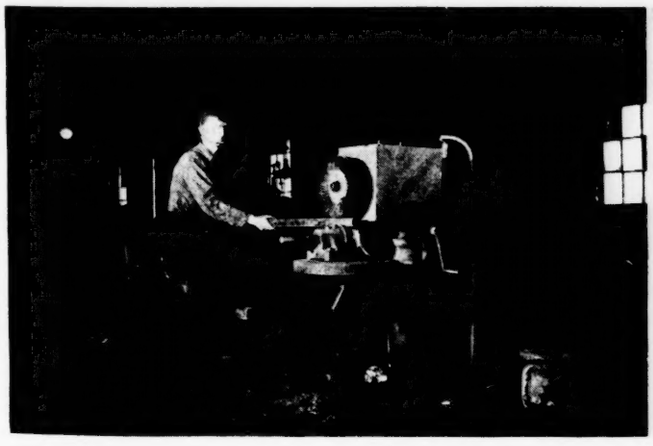
Pipe and Tubing Reclaimed by Brushing Wheels

Widespread application of wire brushing for reclaiming old, rusty, discarded pipe is reported during recent months. This method of quick pipe reconditioning has made it possible to return hundreds of tons of critical piping material back into service.

Typical of such installations is the one at The Builders Structural Steel Co., Cleveland, where pipe in various sizes and lengths is power-brushed to a practically "good-as-new" finish for many kinds of industrial re-use.

Depending upon the size of pipe being cleaned, combinations of two, three, four or more wire brushing wheels with disc center are mounted on a spindle powered by a stationary electric motor. The wire wheels, of about 33-gauge wire, revolve at a speed of 1800 rpm. Pipe is inserted between a roller mounted on the bed of the unit and the operator moves the pipe back and forth about 10 to 12 inches at a time under the revolving brushes, rotating the work slowly to clean all sides.

The roller fixture, which can be replaced with a size roller to fit the diameter of the pipe being brushed, is also adjustable by turning a hand crank on the side of the fixture so that the required pressure can be applied thoroughly to remove all rust and scale deposits.



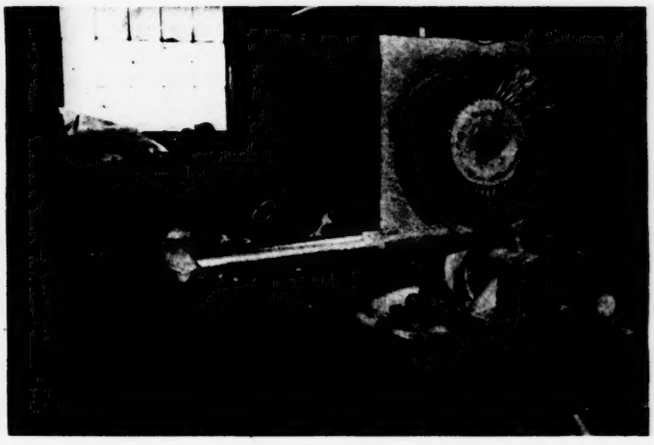
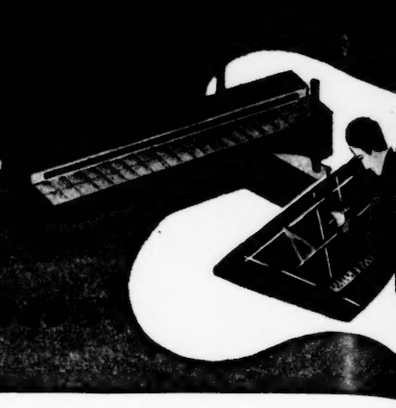


Fig. 1. (Left) Restoring old pipe by means of power brush cleaning method. Fig. 2. (Right) Comparison of cleaned section of pipe with original rusted and corroded surfaces before cleaning.

REVIEWS



FRICTION IN 6 IN. PIPE

This bulletin is divided into six parts. Part I is introductory and gives credit to a number of firms which cooperated in financing the investigation.

Part II is a summary of a more extended report of the investigation published in Transactions, American Society of Heating and Ventilating Engineers, Vol. 47, pp. 71-92. Part III treats of the friction heads in copper, brass, and other hydraulically "smooth" pipe.

Part IV treats of the effect of pipe surface roughness on friction heads. The effect of pipe surface roughness is discussed in detail, the discussion being based largely on the experimental work of Dr. Nikuradse. Part V treats of the effect of water temperature on friction heads in steel, iron and other hydraulically "rough" pipe. A chart is presented by means of which the approximate friction head may be determined for a hydraulically "rough" pipe of any diameter and for water of any velocity and of any temperature. Part VI compares the friction heads secured by experiments at the Agricultural and Mechanical College of Texas in 1940 for 6 in. standard black pipe with those secured experimentally by John R. Freeman in New Hampshire in 1892, and published in 1941 by the American Society of Mechanical Engineers. In general, the friction heads found by Mr. Freeman are about 13% higher for a velocity of 4 ft per sec than those found in Texas; this difference decreases as the velocity decreases. About one-fourth of this difference may be ascribed to differences in pipe diameter and in water temperature; the remaining ¾ may be the result of a difference in pipe surface roughness, which is discussed in detail in the bulletin.

"Friction Heads of Water Flowing in 6 in. Pipe and the Effects of Pipe Surface Roughness and Water Temperature on Friction Heads," F. E. Giesecke and J. S. Hopper, Texas Engineering Experiment Station Bulletin No. 77, A. & M. College of Texas, College Station, Tex.

HANDBOOKS FOR WHOLESALERS AND RETAILERS

Two handbooks outline in great detail procedures whereby individual firms may begin planning now for greatly increased peacetime business.

The retailers' handbook states, "The millions of retail stores in America, well managed, will stimulate the tremendous pulling force of demand in our 137 million people when peace has returned. Then employment will rise to high levels in wholesale, retail and manufacturing establishments alike."

In the book for wholesalers, the statement is made that the wholesaler will not lose his former indispensable place in the consumption line which reaches from factory to family and from farm to family. A most essential service that the wholesaler performs is the credit function. It is a powerful means of expanding the volume of business done in the nation and of increasing the national wealth.

Practical steps in planning for postwar are given in each of the books.

"Handbook for Wholesalers," and "Handbook for Retailers," prepared by the Association of Consulting Management Engineers. Distributed by Committee for Economic Development, 285 Madison Ave., New York 17, N. Y., or any C. E. D. office.

HEAT TRANSFER APPLICATION

The Votator is used for processing margarine, shortening, and lard. Overall coefficients of heat transfer between water and water were determined on a laboratory Votator. This unit was 3 in. diameter and equipped with a mutator, consisting of a 2.25 in. diameter shaft and 2 stainless steel blades. In the tests, water at 175F was pumped through the annular space of the Votator at a rate of about 560 lb per hour, and was cooled with a countercurrent flow of water at 60F on the jacket.

A value of about 800 Btu/(hour) (square foot) (F) was obtained for the over-all coefficient, which varied as follows:

Mutator Speed rpm	Jacket Water Velocity, ft/sec	Over-all Coefficient U
300	5	520
1900	24	1120

The film coefficient on the jacket side varied about as follows:

Jacket Water Velocity, ft/sec	Jacket Side Film Coefficient Btu/(hr) (sq ft) (F)
7.5	1500
26	4100

Values for the film coefficient on the votated water side showed the following variations:

Mutator Speed rpm	Peripheral Speed ft/sec	Votated Water Side Film Coefficient, Btu/(hr) (sq ft) (F)
300	3.9	1100
1000	13.1	2200

"Heat Transfer in the Votator," H. G. Houlton, Industrial and Engineering Chemistry, 36, No. 6, 522-8 (June 1944).

OIL FOR THE WORLD

In a small booklet of 16 pages, an attempt is made to show that "one of the paths to freedom is a comprehensive and enlightened oil policy." Graphic means are employed to show how important oil is to the world's economic structure, and where the actual and potential oil regions are located. The world's oil industry, including personnel, equipment and methods, is largely American. All nations should have access to the raw material through free international economy.

Standard Oil Co. (New Jersey), Room 1626, 30 Rockefeller Plaza, New York 20, N. Y.

TECHNICAL WRITING

This 117-page bulletin contains all the essential information concerning the mechanics of preparing and publishing technical and scientific papers, bulletins and magazine articles in a convenient form.

It takes up the preparation of material for letterpress and non-letterpress publications and for magazine use; it discusses bibliography and footnote forms, the use of numbers, the handling and arrangement of equations and tables, proofreading, abbreviations and letter symbols. There are several helpful sections on the use and preparation of photographs, drawings and charts. A complete list of standard graphical symbols used in technical drawings is given. The whole bulletin is copiously illustrated.

All the details and usages given conform to standard practice and were obtained from reliable authorities. Much of the detailed material applies specifically to the

field of mechanical engineering, but the basic information can be applied to a great variety of technical and scientific work. The publication of this diverse and scattered information in one pamphlet may prove to be of great value in the fields of technical writing.

"Aids to Technical Writing," Richard C. Jordan and Marion J. Edwards, Bulletin No. 21, Engineering Dept., University of Minnesota, Minneapolis 14, Minn. Price, 50c.

ACETONE

In studying the action of acetone, men were exposed to its vapors in a 500 cu ft chamber. The amount of acetone to be evaporated for each test was determined empirically from previous experiments. Air in the chamber was kept stirred continually with a fan, and was analyzed for acetone at 30 minute intervals. Acetone concentrations in air ranged from 1 mg/L to 5.0 mg/L.

When the subject's rate of energy expenditure was approximately tripled, by changing from sitting at rest to steady walking at 3½ to 4 miles an hour, the acetone concentration in the blood was approximately doubled. The latter rate of energy expenditure slightly exceeds the rate in most industrial occupations.

Industrial standards previously proposed for 8 hours daily exposure range from acetone concentrations of 0.5 to 5.0 mg/L (211 to 2110 ppm). The present study indicates that 5.0 mg/L approaches the upper limit of safety for men who perform moderate exertion. With concentrations above 0.5 mg/L during exertion and 1.0 mg/L at rest, acetone would be present in the blood throughout the working week, but in insufficient concentrations to cause intoxication. This study did not determine the effect of acetone in the blood over periods of months or years.

"The Physiological Principles Governing the Action of Acetone Together with Determination of Toxicity," Howard W. Haggard, Leon A. Greenberg and J. McCullough Turner.—J. Industrial Hygiene, 26, No. 5, 133-51 (May 1944).

HEAT TRANSFER NOMOGRAPH

A nomograph for determining the film coefficients of condensing vapors is presented. The following data are required: latent heat of condensation, thermal conductivity, density, viscosity, tube diameter, and temperature drop. Physical properties listed refer to the condensate film at the mean film temperature.

"Film Coefficients for the Condensation of Vapors," Robert F. Benenati and Donald F. Othmer, Chemical and Metallurgical Engineering, 51, No. 5, 107-8 (May 1944).

SAMPLING MICROORGANISMS

Detailed description given of a sieve device for sampling air-borne microorganisms. A box is equipped with an air outlet and holds a standard petri dish with nutrient agar, and a cover consisting of a brass plate with 300 openings each 0.796 mm in diameter. The cover fits the box airtight and is fastened by means of two toggle clamps.

Results show an increase in bacterial counts with the sieve device as compared with the funnel device, when a sieve plate with 150 openings is employed. This becomes even more pronounced when a sieve plate with 300 openings is used. Tables are given to show results.

"A Sieve Device for Sampling Air Borne Microorganisms," H. G. duBuy and L. R. Crisp, Public Health Reports, 59, No. 25, 829-832 (June 30, 1944).

SILICA DUST

Several thousand workers are employed in the United States today on production of piezo or quartz crystals for use in radio transmission. Selected crystals are sawed into wafers with circular diamond-edged saws, about 8 in. diameter, operated at about 2,000 rpm. Coolant consists of an emulsion, prepared from one volume soluble oil to 14 volumes water, and is used two weeks or more before replacement. Edges of small quartz squares are trued with a diamond-wheel grinder, using water or oil emulsion as coolant.

A definite relationship was found between the concentration of atmospheric dust and silica particles in the coolant. The maximum allowable concentration of dust in the atmosphere is generally accepted as 5 MPPCF (million particles per cubic foot of air), where the silica content exceeds 90%. This standard can be maintained by using clear water on the grinding wheel; by using at least five gallons of coolant in a recirculating system; by changing the coolant daily; and by changing the air in the cutting and grinding room 4 to 6 times per hour.

"Control of Silica Dust Hazard in Quartz Crystal Cutting and Grinding," Alex E. Goss, J. Industrial Hygiene, 26, No. 6, 208 9 (June 1944).

PIPING

Practical tests on coated pipe buried in the ground proved that coatings applied by hand in the field were less effective than when applied at a central plant. Many coatings greatly reduced the amount of corrosion during the ten year test, but no coating prevented all corrosion at all test sites for ten years. In general, the effectiveness of a coating was roughly proportional to its thickness, regardless of the kind of bitumen or the structure of the coating.

For gas distribution systems, the two general types of coatings favored are (1) the asphalt-mastic, and (2) reinforced or shielded coat tar enamel, preferably of the so-called plasticized or water works enamel type.

The shield should be permanent, rather stiff, and inorganic to resist bacteria. The coating should be tested for pinholes and abrasions just before it is placed in the trench, preferably by some machine such as the automatic pinhole detector.

"Coatings Useful for Distribution Systems." Kirk H. Logan, American Gas J., 160, No. 5, 61-3 (May 1944).

HEAT TRANSFER

Equipment for heat transfer is reviewed, the subject being classified into heating and cooling of liquids, gases, and solids, distillation of liquids, sublimation of solids, evaporation of liquids, drying solids plus liquids, condensation of vapors, fusion of solids, and freezing of liquids.

Items illustrated relate primarily to chemical processing, but include the evaporative cooler, Baudelot cooler, storage type water heater, Freon-flooded type water cooler, Ljungstrom and other types of air preheaters, steam superheater, Marley cooling tower, surface condensers, and barometric condenser.

"Equipment for Heat Transfer and Heat Application," M. W. Schwarz, Chemical and Metallurgical Engineering, 51, No. 5, 120-8 (May 1944).

THERMAL PROCESSES

The ranges of industrial process temperatures are classified as (1) the refrigeration range, from room temperature down to the melting point of helium; (2) the range of organic processing, from room temperature to about 900F; (3) the range of inorganic processing, from about 600F to the highest temperatures attainable.

Heat production methods, flame temperature and radiation, combustion space, volume and design, electric heat, and heat transfer are reviewed.

"Heat and Cold; Production and Application for

(Concluded on page 82)

(Concluded from page 81)

Processes," William J. Shore, Chemical and Metallurgical Engineering, 51, No. 5, 109-17 (May 1944).

BRINE

Sodium bichromate is added to calcium chloride or sodium chloride brine to inhibit corrosion. Varying amounts of caustic soda are also added to adjust brine pH. The method of test is described, and a chart and disk are presented, for rapid determination of the quantities of chemicals needed per 1000 gals brine.

"An Adjusted Brine Checks Corrosion," George A. Pape. Power, 88, No. 6, pp. 75, 134 (June 1944).

BRIEF REVIEWS

MINERAL WOOL—A 2-page single sheet, standard size, mimeographed report entitled "The Mineral Wool Industry in 1943" and giving statistical information on the production of mineral wool products in the U. S. for 1942 and 1943.

WELDING SAFETY—An attractive 32-page booklet entitled "Safety in Electric and Gas Welding and Cutting Operations," another in the series of American War Standards developed by the American Standards Association. Its preparation was initiated by the International Acetylene Association, American Welding Society, National Electrical Manufacturers Association, and the Division of Labor Standards of the U. S. Department of Labor. The booklet is designed to serve as a guide for the protection of the individual operator from injury or illness, and for the protection of property from fire or other damage arising out of improper methods in the installation, operation, or maintenance of welding and cutting equipment. It covers every phase of safety applicable to all ordinary welding, cutting, brazing, lead burning, and flame-treating operations. It does not attempt to cover any special hazards which may be inherent in the operations of special industries such as explosives manufacturing or shell-loading. Copies may be ordered from American Standards Association, 29 West 39th Street, New York 18, N. Y. Price 40 cents, discount for quantity orders.

VALVES—A proposed simplified practice recommendation for iron and steel relief valves for petroleum, chemicals, and general industrial services, has been submitted to producers, distributors, users, and others interested for approval or comment by the Division of Simplified Practice, National Bureau of Standards. These valves are primarily intended for air, gas, vapor and liquid service requirements for oil refineries, gasoline plants, synthetic rubber projects, and chemical plants; also for general industrial service. Mimeographed copies of the recommendation may be obtained upon request to the Division of Simplified Practice, National Bureau of Standards, Washington 25, D. C.

WHO'S WHO — A 158-page directory of leaders in Refrigeration and Air Conditioning, giving brief but complete biographies of those included. Treated cloth bound, 6 x 9 in. in size. Published by Air Conditioning & Refrigeration News, Business News Publishing Co., 5229 Cass Ave., Detroit 2, Michigan. Price $3 postpaid.

HEATING TANK WATER—A paper describing a temperature control system for water in a storage tank of a dry sprinkler system and giving the results in savings obtained by its installation. The paper is entitled Sprinkler Tank Water Temperature Control, by G. H. Tuttle, The Detroit Edison Co., Detroit, Mich., and presented by him as part of the report of the Commercial Relations Committee of the National District Heating Association at its 1944 Convention in Pittsburgh. Available from J. F. Collins, Jr., Secretary, 827 N. Euclid Ave., Pittsburgh, Pa.

ELECTROTHERMAL SPACE HEATING AND AIR CONDITIONING—A 12-page multilithed paper entitled "Electrothermal Space Heating and Air Conditioning," by Geo. H. Krueger, Bonneville Power Administration, Portland, Oregon, and devoted to the use of off-peak storage of electric energy for the heating of buildings. Describes experiences of the Bonneville Power Authority in this connection. Available from the American Institute of Electrical Engineers, 33 W. 39th St., New York, N. Y. Price 15c per copy by mail.

ELECTRIC PANEL HEATING—A 22-page multilithed paper by B. F. Raber and F. H. Hutchinson, both of the University of California, and entitled "Load Calculation Procedure for Electric Panel Space Heating." Includes detailed calculations. Presented before the American Institute of Electrical Engineers, 33 W. 39th St., New York, and available from them at 30c per copy.

HEAT PUMPS—A 6-page multilithed paper by R. U. Berry, General Electric Co., on possibilities of heat pumps for heating homes. Presented before the American Institute of Electrical Engineers, summer meeting. Available from the A.I.E.E., 33 W. 39th St., New York, at 15c per copy by mail.

HEATED INDUSTRIAL EQUIPMENT—A printed pamphlet entitled "Mineral Wool: Blankets, Blocks, Insulating Cement, and Pipe Insulation for Heated Industrial Equipment, CS 117-44," which has been accepted by the Industry as a standard of practice beginning May 25, 1944, is available from the U. S. Department of Commerce, National Bureau of Standards, Washington 25, D. C.

COAL. A report on the carbonizing (coking) properties of 20 coals from eight States, bringing to 86 the number tested by a method developed by the Bureau in cooperation with the American Gas Association. The 20 coals discussed in the latest report are from Kentucky, Oklahoma, Arkansas, Kansas, Pennsylvania, West Virginia, North Dakota, and Wyoming. Also included in report are descriptions of the development of expansion, oxidation, and spontaneous combustion tests, use of high-volatile coals with low- and high-temperature coke char in connection with the development of suitable blends of Western coking coals, blend tests of Eastern coals with anthracite in coke making, and packing tests, or cake-charging experiments, with coal from the Lower Sunnyside bed of Utah. Report of Investigations 3760, "Work of the Survey of Carbonizing Properties of American Coals," Bureau of Mines, Department of the Interior, Washington 25, D. C.

UNDERGROUND STEAM LINES — A 16 in. underground steam main installed in 1928 at a relatively low cost was recently taken up as leaks had developed. Observations made when the line was removed, together with proposed improvements suggested by the experience, and conclusions for further improvement, are reported in a paper "Lengthening The Life of Underground Steam Lines," by A. A. Sellke, The Detroit Edison Co., in the report of the distribution committee of the National District Heating Association, and presented at the recent meeting of that group. For further information address John F. Collins, Jr., Secretary-Treasurer, National District Heating Association, 827 N. Euclid Ave., Pittsburgh 6, Pa.

CORRECTION—In these pages in the March issue the Code of Recommended Practices for Industrial Housekeeping and Sanitation of the American Foundrymen's Association was erroneously indicated as dealing with foundry ventilation. The Code, primarily, covers industrial housekeeping and sanitation and is not devoted to ventilation.

NEWS OF THE MONTH

NDHA Elects Sanford

Sterling S. Sanford

PITTSBURGH—Sterling S. Sanford, The Detroit Edison Co., was elected president of the National District Heating Association at its 35th annual meeting here in June. Other officers are as follows: First vice-president, Roy M. McQuitty, Union Electric Co. of Missouri, St. Louis, Mo.; second vice-president, John F. Malone, Consolidated Gas Electric Light and Power Co., Baltimore, Md.; third vice-president, Robert B. Martin, New York Steam Corp., New York, N. Y.; executive committee, J. J. Schenk (retiring president), Rochester Gas & Electric Corp., Rochester, N. Y.; Henry L. Martin, Boston Edison Co., Boston, Mass.; David W. Loucks, Allegheny County Steam Heating Co., Pittsburgh, Pa.; secretary-treasurer, John F. Collins, Jr., Pittsburgh, Pa.

Mr. Schenk, in the president's annual address, referred to the activities of the Association in the fuel conservation program, pointing out that steam utilities are selling more heating service than ever before. Secretary-treasurer Collins, in his report, indicated that there is greatly increased interest in district heating both in this country and in England.

R. J. J. Tonnent, chief engineer for a large real estate operating company, told the district heating men of the troubles of their chief customers, building operators, with a decreasing margin between income and costs, limited improvement expenditures, man power shortage, high valuations, high taxes and the demolition of unprofitable buildings. He predicted closer competition later and advised the district heating industry to advertise more widely the advantages of the service, to explain to customers how to operate economically, to be frank and to devise attractice rates.

Harry A. Weitzman, Rochester, reported large increases in heating business obtained by the utilities during the war and told of their expecting to hold most of this and even increase their business in post-war years. New load will be for summer air-conditioning and process work. Improvements to plant are planned as soon as possible. Mr. Martin reported that the Boston Edison Company had used all spare capacity in taking on new customers who formerly had used oil for heating. He said these buildings had been connected with all the temperature control and other equipment required for economical operation. When peace comes they will have experienced satisfactory service and will wish to continue to purchase steam.

Walter A. Schulmeister, American District Steam Co., North Tonawanda, N. Y., presented charts for sizing economizers and condensate coolers based on 100 Btu transfer per hour per sq ft of surface per degree mean temperature difference of the liquids. He explained that for clean ¾ in. tubes, low friction loss and no baffling the transfer usually lies between 85 Btu and 110 Btu.

A. F. Metzger, Pittsburgh, presented a table showing the estimated monthly steam use for water heating in office buildings, department stores, hotels, resident clubs, apartment houses, parking garages and theatres in pounds per cubic foot of space per 100F increase in water temperature per year with or without economizers. Knowing the water temperatures and the steam use in summer, from this table one can estimate the steam required to heat water each month of the year in buildings where there is only a totalizing steam meter.

A. R. Mumford, reporting for the research committee, said that the committee had found the "exposed area" basis of comparing steam use in buildings is much more accurate than the present "volume" basis, and reported four firms selling steam for summer air conditioning.

Speaking as chairman of the national joint committee on weather statistics, Mr. Collins said that the committee had agreed on (1) use of daily mean temperatures rather than daily average temperatures for degree-day computation; (2) use of maximum-minimum thermometers rather than thermographs; (3) retention of the present 65F base for normal occupancy; and (4) use of the 20-year average (adjusted) for computing normal degree-days for each day.

Leo F. Collins, Detroit, in presenting the report of the chemistry committee, said that corrosion troubles in heating systems are often the result of the action of carbon dioxide. Proper venting can be devised where large amounts are present. Where small amounts are responsible for corrosion, ultimately boiler water treating methods will be developed to eliminate CO_2 or chemicals produced to neutralize it. Guest speaker A. A. Bork, associate chemist of the U. S. Bureau of Mines, in concurring with Chairman Collins, said additional tests will be run to determine which mines should be used for the most economical treatment.

Mr. Schulmeister reported that recent examinations of cell-concrete insulation installations made the past ten years showed them to have remained stable and without corrosion trouble.

Use of Single Room Coolers to Expand

PHILADELPHIA—Even though five or six years ago practically nobody knew about single-room fractional horsepower air conditioners or room coolers, Harry Boyd Brown, manager of air conditioning for Philco Corp., believes that the post-war period will show an increase in their use of from 200 to 300%.

"The fact that very few people understood what a room cooler was, what it did or how it functioned was probably the chief reason the entire industry sold only 30,000 to 40,000 of these units a year before the war," Mr. Brown stated.

Mr. Brown believes that three or four years after the war, annual volume should increase to six or eight times that of 1941. In that event the business might amount to $60,000,000 a year. Post-war units will be lighter in weight, and therefore, even more easily installed.

Church Building Boom Anticipated

NEW YORK—Revising his earlier figure of $300,000,000 Elbert M. Conover, director of the Interdenominational Bureau of Architecture, now estimates that post-war church construction and renovation will total $500,000,000. His estimate includes plans for remodeling and enlarging present facilities, replacement of structures destroyed by fire and erection of buildings in unchurched areas.

Mr. Conover, whose bureau is the consulting agency for some twenty-five Protestant denominations affiliated with the Home Missions Council of North America, said new churches will be built by congregations moving from downtown business locations to residential areas and others to replace many of the 40,000 churches that are now confined to one room.

(Continued on page 84)

(Continued from page 83)

Fuel Conservation Featured by ASHVE

GRAND RAPIDS—Members of the American Society of Heating and Ventilating Engineers at the semi-annual meeting here voted that the Society give "full support to the Government in the National Fuel Efficiency Program to expedite the war effort by helping to prevent the needless waste of heat and power." A panel dicussion on fuel conservation, mainly devoted to fuel utilization, was the feature of the meeting.

Among the papers was one given by L. T. Wright, Jr., Ithaca, N. Y., co-author with Prof. C. O. Mackey, on "Periodic Heat Flow — Homogeneous Walls or Roofs." The paper showed the results of a cooperative research program obtained during 1943. An exact and an approximate method are given for finding the contribution to the cooling load due to heat transfer from the inside surface of a homogeneous wall or roof under the following conditions: (1) a cyclic variation of the temperature of outdoor air and the total solar radiation incident upon the building surface within a period of 24 hours; (2) a constant temperature of the indoor air.

Merrill F. Blankin, Philadelphia, past-president of the ASHVE, was chairman of the panel discussion on fuel conservation. Those in the panel were: John James, Cleveland; R. C. Champlin, Detroit; Frank Connell, Detroit; C. C. DeWitt, Lansing, Mich., and M. W. Crew, Milwaukee.

Prof. William F. Wells, Philadelphia, Pa., gave a paper, "Air Desinfection in Ventilation," in which the author reviewed the theories developed and the progress made in the study of respiratory contagion and in the control of airborne infection. Conclusions are given regarding use of ultraviolet rays, aerosols and disinfectants in sanitary ventilation, and the author made suggestions for further progress.

Dr. Allen D. Brandt, Chicago, presented a paper on "Industrial Exhaust Ventilation in Industrial Hygiene." He brought out the fact that the average worker, when considered as a group, shows no ill effects when exposed to atmospheric contaminants, below the maximum allowable concentration. Local exhaust ventilation is best suited for specific and major sources of contamination while general ventilation is best suited for scattered and minor sources, as was pointed out by the author. He also brought out the fact that there are four main types of local exhaust hoods and for each the entering air flow is different. Dr. Brandt felt that with the information available today there is little excuse for the existence of atmospheric contamination of such order that the health of the workers is affected adversely.

Prof. W. A. Hinton was the author of a paper on "Some Effects of Attic Fan Operation on Comfort," which he prepared with W. G. Wanamaker. The author explained that when cool night air was drawn through a single story frame structure at a rate of 45 air changes per hour, inside air temperature was reduced to within 2F of the outside air temperature. He further stated that air velocities ranging from 18 fpm to 169 fpm were observed. Mean radiant temperature was found to average approximately one degree above inside air temperature. Effective temperatures in the comfort zone were obtained early in the evening, from 7:00 to 8:30, depending on outside air temperatures and air velocities used in the house.

The Society made grants of nearly $10,000 for cooperative research covering 10 projects at seven universities, according to Professor G. L. Tuve, chairman of the Committee on Research. Studies are scheduled at Cornell University, Case School of Applied Science, University of California, Oregon State College, University of Minnesota, University of Pennsylvania, and Texas A. and M. These agreements cover the period commencing July 1 and represent the beginning of a program that involves the investigation of over 30 projects at the Society's research laboratory in Cleveland and in various universities and colleges under the direction of Cyril Tasker, director research.

Foresees Greater Use of Aluminum

NEW YORK—A film, A Recital of Faith, which portrays the role Reynolds Metals Co. is playing in the war effort and will play in the post-war period, was shown here recently. The film ends with the answer to the question What does the future hold for aluminum? The answer, according to Reid B. Gray, Reynolds Research Institute, is that there will be no limit to the use of aluminum after the war

"Transportation," he says, "will continue to be the number one user of aluminum—transportation by air, land and sea. Yes, aluminum will go to the sea in ships, and aluminum freight cars, particularly refrigeration cars, are almost a certainty. Also, don't be surprised if the future automobile takes advantage of the lighter metals. Construction and housing will unquestionably use tremendous quantities of aluminum and in infinite variety. Industrial plants will need more and more of it, particularly the food industry in its processing equipment.

Indoor Climate Institute Appoints Secretary

DETROIT—Arthur E. Schanuel, formerly with the National Electrical Manufacturers Association, has been appointed executive secretary of the Indoor Climate Institute, effective July 1.

A two-day open forum is planned by the Institute to be held at the Book-Cadillac Hotel here September 21-22. Following the forum, committees of I.C.I. and its membership will be coordinated into a program of research and promotion to focus attention of the public upon the subject of indoor climate and its effect upon human comfort, health, and efficiency.

Arthur E. Schanuel

The Institute has issued a progress report to its members, supplemented by a question and answer bulletin, which clarifies the manner in which I.C.I. will function under a committee form of structure. The principal committee chairmen are as follows: Public Information Committee, chairman, C. D. Lyford, Minneapolis-Honeywell Regulator Co.; Trade Associations Committee, chairman, J. M. McClintock, sales manager, Illinois Iron & Bolt Co.; Membership Committee, chairman, T. A. Crawford, general sales manager, Timken Silent Automatic Division; Science Committee, chairman, Willis Carrier, chairman of the board, Carrier Corporation; vice-chairman, L. N. Hunter, vice-president, National Radiator Company; Finance Committee, officers of the Institute; Local Chapters Committee, chairman, Jack Searls, sales manager, White Rodgers Electric Co.; Post-war Personnel and Training Committee, chairman, J. R. Scott, assistant to the president, L. J. Mueller Furnace Co.; Speakers' Bureau Committee, chairman, John Knighton, sales manager, Servel, Inc.; Promotional Committee, chairman, C. T. Burg, general sales manager, Iron Fireman Mfg. Company.

The Institute has moved into new offices in the Penobscot Building here.

Stoker Rating Codes Adopted by Manufacturers

CHICAGO—The Stoker Manufacturers' Association has established standard codes for the determination of rated capacities of both bituminous and anthracite underfeed stokers, it was jointly announced July 20 by J. M. McClintock, Chicago, president of the Association, and A. O. Dady, Bradley, Ill., chairman of the Association's engineering and research committee. These codes provide a uniform method for the testing and rating of underfeed stoker equipment up to 1,200 lb of coal per hour capacity and were unanimously approved and adopted at the recent annual meeting and war conference of the Association.

Under the provisions of the two codes—one covering bituminous stokers and the other anthracite stokers—the manufacturers complying with the S.M.A. standard rating guarantee that their equipment in the various sizes and models will feed and burn coal or coals of a standard specification or specifications and under certain draft and operating conditions at the rated capacity in pounds per hour continuously "when properly installed, adjusted, and attended in furnaces no smaller than specified in the S.M.A. Recommended Furnace Dimensions." The purpose of the codes is to establish a uniform method of rating single retort underfeed stokers having a nominal capacity of 1,200 lb per hr coal feed or less. The codes provide that any member of the Association in good standing shall be privileged to use the S.M.A. rating on his equipment so long as he complies with the provision of the codes. There are differences in the two codes largely based on the different characteristics between anthracite and bituminous coals.

Name plates used by the individual manufacturers showing the S.M.A. rating must also carry the manufacturer's name and the S.M.A. insignia on the same plate. The Association has furnished individual manufacturers a suggested design and wording for a name plate, which is being used merely as a guide or reference by each manufacturer in designing their own individual plates signifying compliance with the codes.

The codes also provide that no manufacturer using this method of certifying stoker capacities shall publish or permit the use in advertising or otherwise of ratings in excess of the S.M.A. rating for any model so identified.

Simultaneously with the release of these new codes, Mr. Dady also stated that the Association's engineering and research committee is trying hard to complete work on a new stoker engineering and technical manual for publication and distribution as early as possible. This new manual will incorporate the various S.M.A. standards and recommendations, as well as other technical and practical information designed to be of the greatest possible value to users, consulting engineers, heating contractors, distributors and dealers.

Rapid Test Certification of New Materials Urged

WASHINGTON—Local building officials are urged by The Producers' Council to help speed up the acceptance and use of new building products and construction methods after the war by cooperating with manufacturers of materials and equipment in developing a plan for coordinating private and public testing facilities.

"The first five years after the war undoubtedly will see the introduction of more new building products than any comparable period in the past, as the result of improvements perfected in connection with the vast war construction program," Tyler S. Rogers, chairman of the Council's technical committee, stated.

"For the most part the new products and new building techniques will be introduced gradually, owing to the need for further experimentation, so that there will be no revoluntionary change in post-war construction, but experience shows that the general adoption of new developments will be slowed up greatly unless some means is found for certifying reliable tests in such a way that the facts can be accepted without question in any place.

"In the past manufacturers' tests have had to be rechecked in almost every individual city, with the result that long delays have occurred in many cases before the products or construction techniques could be approved for local use. These delays are costly both to manufacturers and to the public and definitely tend to retard progress in construction."

New War Housing Planned

WASHINGTON—Housing construction to relieve shortages in homes for resident war workers will be started soon and will be known as H-2 housing. At present it is believed that several thousand dwelling units will be started this year. During 1945, about 25,000 units are expected to be completed every three months. For the time being, the H-2 housing will be limited to war production areas.

WFA Takes Over Cold Mine

WASHINGTON—Having completed arrangements to lease a 75-year-old limestone mine near Atchison, Kan., the War Food Administration has moved closer to realization of plans to convert the mine's estimated 12,000,000 cu ft of space into a storage vault for Government-owned lard, eggs and other perishables.

The project, which has taken on important proportions, includes installation of refrigerating machinery to give the mine a temperature between 30 and 32F. Its normal temperature is about 50F. This will make it the largest single refrigerated storage house in the United States, its total cubic footage alone being equivalent to about 9% of all public cooler space in this country.

Naturally insulated with 100 feet of earth and stone, the huge, dry cave has railroad sidings and other attributes of a well-kept warehouse. It has capacity sufficient to hold 3,000 to 3,500 carloads of food, or the equivalent of 60,000 to 75,000 tons, depending on density.

WFA officials, who are hopeful of placing parts of the mine in operation by late summer, estimate it will result in considerable saving annually to the Government. A building with the same floor space would cost approximately $15,000,000 to construct. It is estimated the Atchison project will cost about one-tenth this amount.

Lard will be stored first, then as the vast interior becomes chilled, fat-backs, salt meats and cured meats, dried fruits, dried eggs and similar commodities will be put away for future use.

Stoker School Planned

CHICAGO—The Midwest Stoker Association is considering a school for apartment house janitors and custodians on the operation and care of stokers. This is being undertaken in cooperation with the Chicago Flat Janitors Union. A written course will be prepared and classes will be held, probably during August, where stoker engineers and servicemen will explain the operation of stokers in an effort to assist the janitors in securing a better understanding of their principles.

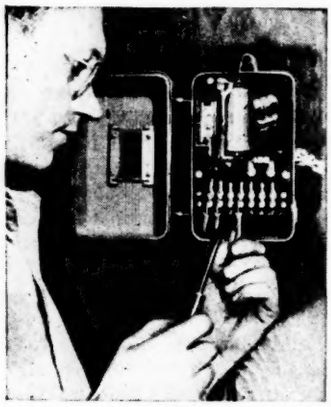
Officers elected at the Association's recent annual meeting are: president, J. J. Hayes, manager, Auburn Stoker Co.; vice-president, W. J. O'Neil, branch manager, Iron Fireman Mfg. Co.; and secretary-treasurer, J. G. Beard, assistant manager, Stoker Div., Illinois Iron & Bolt Co., all of Chicago. At the same time several committees were appointed and active work will be started by the Association following an inactive war period.

(Continued on page 102)

NEWS OF EQUIPMENT AND MATERIALS

Electronic Relay

NAME—G-E electronic relay.
PURPOSE—Amplifying limited current transmitted by control contacts.
FEATURES — Relay operated by any material having resistance from 0 to



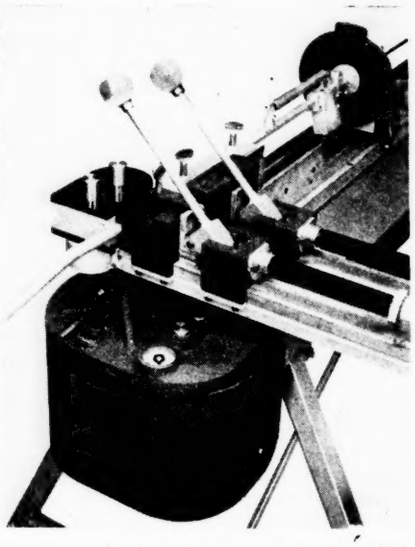
500,000 ohms. Is especially suitable for controlling liquid levels in tanks and boilers and similar applications. Small, light in weight, relay consists of standard type electronic tube, supply transformer, and an electromagnetic relay, all mounted in enclosed weather-resistant casing suitable for wall or machine mounting.
MADE BY—*General Electric Co., Schenectady, N. Y.*

Duralon

NAME—Duralon.
PURPOSE—A basic resin with widespread applications, currently available for limited commercial and experimental use.
FEATURES—Duralon is a furane derivative with varying physical and electrical properties depending on the incorporation of catalysts and application of mild heat. May be applied as coatings or may be used for impregnation of porous materials or as a bonding agent. Duralon coatings, after baking, are hard and while somewhat more brittle than coatings of the thermoplastic type, show excellent abrasion resistance and lack of aging characteristics. The water and solvent resistance of the pure Duralon resin is fully imparted to coatings made from the resin. Such coatings show practically zero water absorption, are unaffected by any solvent, possess high resistance to non-oxidizing acids, and good resistance to alkaline materials. Products made from Duralon resins not only show a permanence of properties at normal temperatures but apparently retain a preponderance of their desirable properties at temperatures in excess of 400F.
MADE BY — *The United States Stoneware Co., Akron, Ohio.*

Tubing Bender

NAME—Leonard-Douglas Bendmaster.
PURPOSE — For bending non-ferrous tubing.
FEATURES—Device, a manually-operated tube bender, at minimum operating efficiency, is said to give a production two and a half to three times as fast as the best methods available up to this time. Set-up of machine averages 7 to 15 minutes. Cam arrangement and automatic stops adjusted according to specifications on job ticket and machine is ready for production. Machines now in operation in aircraft plants on West Coast. Although originally designed for aircraft production, machine can be utilized in many industries.
SIZES AND CAPACITIES—Will produce from 900 to 1000 bends per hour on non-ferrous tubing, from ⅜ to 1¼ in.



O.D., producing from one to ten different bends in single 9 ft lengths of tubing. Bends can be produced to any angle up to 180° and at any radial angle.
MADE BY—*Leonard Precision Products Co., 1100 Larson Ave., Garden Grove, Calif., under exclusive license arrangement with Douglas Aircraft Co.*

Thermopane

NAME—Thermopane window glass.
PURPOSE—Reducing heat losses through windows.
FEATURES — Insulating window glass formed in units consisting of two panes of polished plate glass which form an insulating sandwich with a dehydrated air space hermetically sealed in by a metal-to-glass bond around the edges of the glass Over-all thickness is 7/16 in. which includes an air space of 7/32 in. Units are already in military use in various thicknesses to protect Army Signal Corps instruments.
SIZES AND CAPACITIES—Precut to any given window dimension up to 8 x 5 ft.
MADE BY — *Libbey-Owens-Ford Glass Co., Toledo, Ohio.*

Hose Clamp

NAME—One-piece hose clamp.
PURPOSE—For clamping hose without

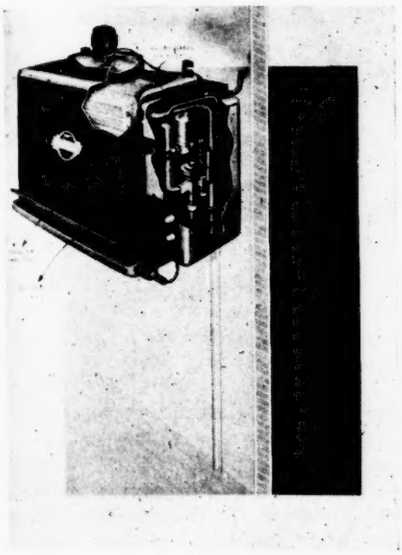
use of gears, thumb screws or intricate locking means.
FEATURES — Clamp may be snapped over hose into pre-latched position by hand. as shown in left illustration. Final lock is made with hand pressure on ordinary pliers, as at right. Has a low profile, is light in weight, and exerts an even pressure around entire circumference of hose. May be quickly released for removal with an ordinary screw driver or other pointed tool.
SIZES AND CAPACITIES—All sizes of AN and ordnance specification hose from ½ in. O.D. and up.
MADE BY—*Tinnerman Products, Inc., 2014 Fulton Rd., Cleveland 13, Ohio.*

Time Delay Relays

NAME—Cramer type TDSA and TDSB time delay relay, additions to company's line of electrical timers.
FEATURES—New relays have been designed to provide definitely varied operation of one circuit in relation to second circuit. Arranged for surface mounting for either front or rear connections and to withstand momentary shock conditions.
MADE BY—*The R. W. Cramer Co., Inc., Centerbrook, Conn.*

Amcoil Food Conditioner

NAME—Amcoil food conditioner.
PURPOSE—To cool air and control high humidities and in that way preserve foods by limiting dehydration. Particularly suitable for preserving fresh meats, fruits and vegetables, for dough retarding, storage



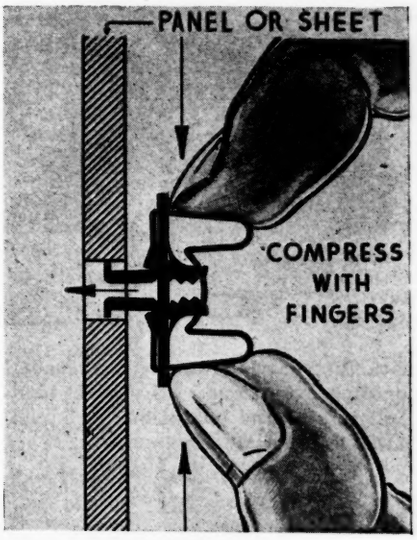
of eggs, poultry and fish, pastry and confectionery products and tobacco.
FEATURES—Wall-mounted, one-man-hanger type, designed for use in walk-in boxes. Temperatures automatically controlled down to 35F and relative humidities up to 93%. Air is drawn into top of casing by fan, directed downward. Casing is partitioned into two parts, the major portion being occupied by evaporator coil. Main stream of air is directed through this coil. Partition directly behind coil provides vertical passage through which balance of air stream is directed downward over water collected in drain pan recess. Immersion heater, located in drain pan recess, is energized by a humidistat when humidity is required. Cooled air and moisture-laden, recirculated air join and are directed into refrigerator space by air control deflector. Cabinet fabricated of heavy gage metal, oven-baked ripple or maroon and black finish.
MADE BY—*American Coils Co., 25-27 Lexington St., Newark 5, N. J.*

Compressor-Trol

NAME—Ashcroft Compressor-Trol
PURPOSE—Combines seven devices for control of compressor operations into single unit.
FEATURES—Eliminates necessity of using pipe and pipe fitting, thus simplifying installation. Equipped with Duraswitch, with either an electric or mechanical attachment for operating the two-way unloading valve.
SIZES AND CAPACITIES — Three sizes, ½, ¾ and 1¼ in.; size determined by inlet connection. To cover all requirements of tank compressors up to 16 hp. or 60 cfm. Can be furnished in all standard pressure ranges.
MADE BY—*Electro-Mechanical Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.*

Speed Nut for Panels

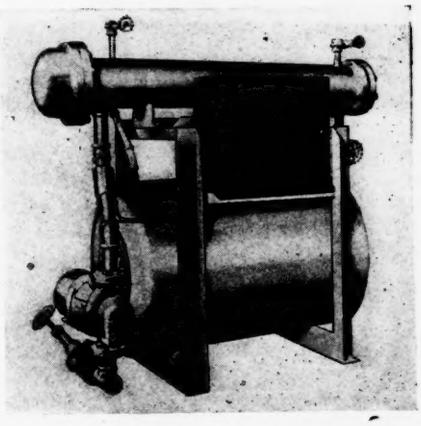
NAME—Self-locking speed nut.
PURPOSE — For attaching screws to panels or sheets in blind positions.
FEATURES — Nut is compressed as shown in illustration; when inserted in hole legs spring apart with turned up ends clearing backside panel. Nut will hold tight against force of inserting the screw and the screw-tightening torque.
SIZES AND CAPACITIES — Available in two styles, A5939, made of brass and phosphor bronze, for use with standard 6-32 machine screws, and A5939, made entirely of spring steel, for use with standard 6Z sheet metal screws. Both styles are available to fit panel thicknesses from .062 in. up, and re-



quire only one clearance hole of .171 in. diameter to attach.
MADE BY—*Tinnerman Products Inc., 2010 Fulton Rd., Cleveland 13, Ohio.*

Trane Pasteurizer

NAME—Trane oil pasteurizer.
PURPOSE — For pasteurizing cutting oils so as to destroy bacteria which cause dermatitis.
FEATURES—Consists primarily of oil storage tank, circulating pump and shell and tube heat exchangers. Exchanger is used both for heating oil and later to re-cool oil back to usable temperature. Oil is pumped from drum into storage tank for circulating pump. After filling, steam is admitted to exchanger where oil is heated to 240F in 10 to 20 minutes. This temperature is held for 30 minutes with pump running continuously, circulating oil from tank through ex-



changers and back. At end of holding period, cold water is admitted at 75F to heat exchangers, thus cooling oil back to 80F in about 45 minutes. Oil is then pumped out of pasteurizer into fresh drum and is ready for use. Controls consist of two thermostats and two motorized valves. One valve is connected to steam line, second to water line. Thermostat of the steam valve is set at 240F and as long as oil temperature is below this steam valve will be wide open. Second thermostat at 80F controls operation of modulating water valve. Pasteurizer may be arranged in large installations so as to continuously circulate oil.
MADE BY—*The Trane Co., La Crosse, Wisc.*

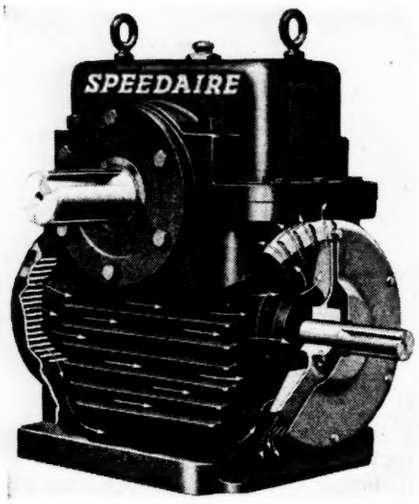
Rust Inhibitors

NAME—Cyclodiene and Percyclodiene.
PURPOSE—Rust preventives.
FEATURES — Products are actually metal cleaning solvents which have protective films that prevent rust and tarnish. Both are used as short time simple immersions at room temperature and are used in a metal tank, glazed ceramic or other material. Neither will attack metals as they are neutral and contain no acids, alkalies or water. Films from Cyclodiene dry in about 20 minutes leaving rust inhibited clean surfaces for a short time thereafter. Films from Percyclodiene will remain for about 30 days leaving rust inhibited surfaces for quite sometime thereafter.
LITERATURE AVAILABLE — Small free samples of both products are available to industrial firms.
MADE BY — *The Technical Processes Div., Colonial Alloys Co., Philadelphia, Pa.*

Fan Cooled Speed Reducer

NAME—Speedaire worm gear reduction unit.

PURPOSE—A speed reducing unit incorporating a fan cooling system which permits a pronounced reduction in size of the unit required for a given horsepower output.



FEATURES—Basis of cooling system is double wall construction. This provides an air passage completely enveloping oil reservoir in which gear operates. Inner housing wall forming oil reservoir is deeply finned on air side, resulting in a marked increase in heat-dissipating surface. Exhaust fan located on coupling end of worm shaft draws air at high velocity through space between housing walls from a grille at opposite end of unit. Effect of double wall construction is to maintain a uniform flow of cooling air against the fins and housing wall over whole oil reservoir surface, and thus utilize full heat transfer efficiency of system. Operating temperature is greatly lowered by high velocity air stream enveloping oil reservoir.

MADE BY—*The Cleveland Worm & Gear Company, Cleveland, Ohio.*

Perfex Control System

NAME — Perfex combustion control system.

PURPOSE—Thermostatically-regulated combustion control system for hand-fired heating plants.

FEATURES—Includes a new barometric draft control with an attached Thermo-draulic damper operator, Magic Dial thermostat, and a limit control. Lightweight square vane of the barometric draft control is mounted in a square channel, allowing generous air intake and positive checking action. Rolling spring steel hinge featured in barometric control eliminates binding or sticking which has often been a fault of bearing type of pivot. Damper operator, which is linked to the draft door and vane of the barometic control, functions through hydraulic action, and has a safety cutoff feature in case of power failure.

MADE BY—*Perfex Corp., 500 W. Oklahoma Ave., Milwaukee 7, Wisc.*

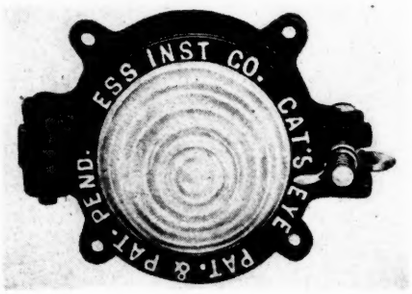
Cat's Eye

NAME—Cat's eye.

PURPOSE—A port-hole for observing flame in fireboxes.

FEATURES — Design and construction is such that shadows and flame characteristics can be seen at a glance from any point in boiler room. Said to be safe, has no glare, and will not permit flareback. By looking through it one can see furnace flame, its turbulence, and smoke-haze, and the operator can make necessary adjustments in fuel-air ratio without leaving his station. Center of 'Eye' is clear to show flame in its natural color; outer frosted portion is a sensitive shadow-screen reflecting slight change in combustion.

SIZES AND CAPACITIES—Made in three models; (A) with external lugs; (B)



with internal lugs and (C) threaded for pipe extensions. All models identical in size and operation.

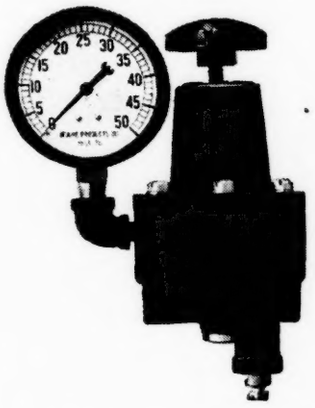
MADE BY—*Ess Instrument Co., Fort Lee, N. J.*

Air Pressure Regulator

NAME — Moore Nullmatic pressure regulator.

PURPOSE—To hold air pressures constant regardless of variations of flow or supply pressures.

FEATURES—Operates on the pneumatic null balance principle and may better be described as a pressure controller, since main air valve is operated by a detecting nozzle. This nozzle operates with a constant differential pressure to hold manual loading spring at essentially same position regardless of variations in flow or in supply pressure. An automatic bleed is provided, to operate when reduced regulated pressure is required. Automatic bleed also serves to permit reverse flow when regulator is used as limit control on industrial instrument applications. Neoprene diaphragms used are suitable for continuous operation at temperatures up to that of 225F.



SIZES AND CAPACITIES—Three standard ranges: 0—15 per sq. in.; 0—30 per sq. in.; 10—50 per sq. in.; suitable for use on supply pressures up to 150 per sq in. Provision is made for panel or pipe mounting as the customer may require.

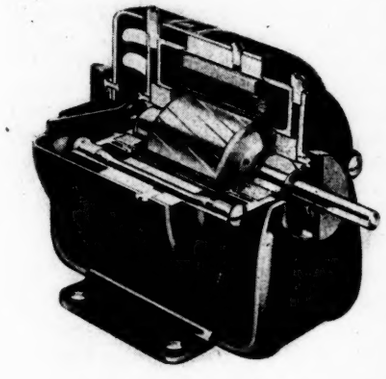
MADE BY—*Moore Products Co., H & Lycoming Sts., Philadelphia 24, Pa.*

Micromotor

NAME—Type T Micromotor.

PURPOSE — Shaded pole totally enclosed motor.

FEATURES — Incorporates a pressure-locked resilient, rubber mounting, to provide quiet operation. Mounting assembly consists simply of two rubber pads, two spring steel lock rings, and a base welded into a single rigid unit.



SIZES AND CAPACITIES—1/125 up to 1/25 hp.

MADE BY—*A. G. Redmond Co., Owosso, Mich.*

WASHINGTON NEWS

Steel Boiler Need Mounts, No Relief Seen; Freon Restriction End May Be In Sight; A. C. Reconversion To Be Charted.

Summarized by LORING F. OVERMAN

August 16, 1944, may turn out to be a day of more than usual significance for the air conditioning and commercial refrigeration industries.

On that day those charged with designing and engineering the industries' return from war production to civilian activities may be given a preview of the government's blueprints and charts that must be worked into anything emerging from industry planners' drawing boards in the immediate future.

The occasion is the monthly Washington meeting of the General Refrigeration and Air Conditioning Advisory Committee. The preview is expected to chart the industry's reconversion course—based on results of an industry-wide survey now in progress, and on recommendations of task committees privileged to analyze the data submitted.

Official Washington may waver between war-end optimism and the suspicion that present rapid developments are too good to be true, but the WPB Refrigeration and Air Conditioning Section has made its plans not to be caught napping by a sudden peace and its inevitable cutbacks in orders for war material. Under a new chief — Charles M. Stuart—the Section is putting its house in order.

Freon Release Likely

Another August date of importance to the air conditioning industry is August 31, when restrictions on the delivery of Freon under Order M-28 to a long list of comfort air-conditioning systems is slated to expire. WPB officials are hopeful that addition of new production facilities about the middle of the month at East Chicago will make it unnecessary to continue the restrictions fixed by List A in Order M-28.

Officials indicate, however, that any great scramble for Freon supplies upon expiration of the restrictions could result in continuation of the prohibition, since the East Chicago Freon plant may not get into full production on schedule. It was further indicated that it will be some time after peak production is reached before it will be possible to build inventory sufficiently to meet any great increase in demand.

On the assumption, however, that moderate releases will be possible, A-C branch officials are considering suggesting that system operators having facilities for off-season storage of augmented charges within their systems, "load up" during the winter months in anticipation of next season. Shortage of cylinders will continue to be the bottleneck in such a storage program, for no cylinders will be available for standby charges and only those whose systems will accommodate additional charges will be in a position to take advantage of the suggestion.

Another Freon Use?

Just as few air conditioning system operators could guess in advance of the war that they would have to compete for Freon supplies with a mosquito-killing insecticide, few are probably aware that a new competitor may soon be in the market. The current issue of *Science* magazine is slated to contain an article by Dr. Lyle Goodhue and Dr. E. R. McGovern, U. S. Department of Agriculture, suggesting the use of Freon as an activating agent to sterilize and purify the air in school rooms, offices and other closed public spaces with propylene glycol.

L-38 Revision Imminent

As a first step in its plans for a streamlined unwinding of WPB restrictions, the Section expects to issue—perhaps prior to the Industry Advisory Committee meeting — a much simplified version of Limitation Order L-38, the present controlling order on production by the industry. While making no important change in restrictions on types of production permitted, or end-uses to which such production may be devoted, the simplified order will provide a flexible framework for activating such programs as may be recommended by the IAC, for release as rapidly as military, metals, and manpower conditions permit.

As an example of this flexibility, the current version of L-38 permits the manufacture, during a given quarter, of one-sixteenth of the aggregate dollar volume of certain classes of new systems and parts produced by a manufacturer during 1940, in addition to his current production required to fill all orders for direct use by the Army, Navy, Marine Commission or War Shipping Administration. Under the Amended Order L-38, the yearly percentage and the list of permitted items will remain the same (25% of 1940), but production of the entire 25% will be permitted in a single quarter, if the manufacturer's schedule will permit.

The change, agreed upon by IAC members and WPB air-conditioning and refrigeration branch officials, will permit a more economical scheduling of permitted production. Equally important, it will permit a producer to step into a "25% of 1941" production schedule at the drop of a hat, if war conditions permit, without awaiting the lengthy procedure that frequently attends the amendment of a limitation order. And once the ball has started rolling, further expansion of quotas could be quickly authorized.

In place of the four schedules that now are appended to the Order, a single list will assign production quotas, some at zero levels in the initial order. Wherever such zero quotas appear, however, production can be quickly authorized at a later date by making minor changes in the production schedule alone, without completely amending the order.

Other changes in the order are expected to clarify misunderstandings regarding required ratings, eliminate abuses that have resulted from certain loopholes, and cancel references to certain inventory stocks that may now be presumed to be non-existent.

A new paragraph is expected to permit experimental models to be built in accordance with Preference Rating Order P-43—the Laboratory rating order which has just been amended to encourage production of postwar models for testing purposes only.

A-C Section's New Chief

The fact that WPB's Refrigeration and Air Conditioning Section has a new chief and has lost the man at the helm during the difficult days of enacting and enforcing necessary but often odious wartime restrictions, is worthy of more than passing mention. The retiring chief, Sterling Smith, who will join the staff of the commercial refrigeration division of the Mills Industries, Chi-

cago, after an extended vacation, was with Nash-Kelvinator Corporation, New York, before becoming affiliated with WPB in September, 1941.

Charles M. Stuart, who succeeds him, has been deputy chief of the special equipment branch of the General Industrial Equipment Division of WPB. As deputy chief, he is thoroughly grounded in the affairs of the affiliated Refrigeration and Air-Conditioning Section, which administers regulations governing production and distribution of refrigeration and air conditioning equipment, refrigerants, and regulations governing emergency service of refrigerating equipment.

Gas Cylinders Shifted

Production and distribution of gas cylinders have been placed under General Scheduling Order M-293 in an administrative change revoking the previous governing order, M-233. The industry will notice little change as a result of the shift; will continue to use the same forms previously required, and will operate under similar procedure. Under M-293, gas cylinders will be known as Class X products, and will have their own table, No. 17. Production is now limited almost entirely to military need, including the carrying of oxygen for airplane crews.

Boiler Production Urged

A reported need for 3,000 low pressure steel boilers for the last half of 1944 and 7,000 for 1945 has failed, to date, to win for the steel boiler industry any WPB encouragement of requests for permission to begin immediate production. Members of the steel boiler industry advisory committee, meeting in late July in Washington, were told there appears to be no hope of any increase in the availability of facilities for rolling steel plate for the next three to six months.

Plate production has fallen behind from 70,000 to 75,000 tons per month during the last three months because of manpower shortages, Committee members were informed by representatives of WPB's Iron and Steel Division. Production of low pressure steel boilers having 129 feet of heating surface or less is prohibited by Order M-126. The prohibition has been in effect for two years and inventories have been completely exhausted.

The Committee also received scant encouragement on its proposal that other types of boilers be removed from scheduling restrictions under the General Scheduling Order, M-293. Plumbing and Heating Division officials explained that the purpose in placing boilers under scheduling restrictions was to assure delivery at the time promised to important claimant agencies such as the Army, Navy, Maritime Commission and the War Shipping Administration. The need for such deliveries still exists, officials reported, and the scheduling procedure is accomplishing the desired results.

Heating Controls Publicized

Heating controls, production of a sizable schedule of which was recently authorized by WPB, came in for a promised place in the publicity spotlight when the WPB Conservation Division released its initial propaganda designed to encourage further fuel saving during the coming winter.

Howard Coonley, director of the WPB Conservation Division, was quoted in initial releases as urging that immediate steps be taken to "winterize" homes, with a saving of 6,000,000 tons of coal as the program goal.

"The ordinary American home can save 10 to 20% on fuel by winterizing," which Mr. Coonley suggested should include the following 10-point program: (1) repair roofs and flashings; (2) weatherstrip all windows and doors and caulk cracks around them and at all other points; (3) install storm doors and windows; (4) insulate attic floor or roof; (5) insulate walls wherever practicable; (6) install winter vestibules; (7) heat-seal wall dividing off unused or rarely used parts of the house and also the ceilings of unheated basements, cellars and other spaces under the house; (8) insulate unprotected portions of the home's heating equipment and clean, repair and adjust all parts of it; (9) install automatic temperature controls and draft regulators; (10) check existing controls and regulators for efficiency of operation.

Over-all Reconversion

Two steps of the Donald Nelson program to hasten the over-all conversion program and to have industry in readiness for production when the war actually ends, have been completed and two await issuance. Orders lifting some of previous restrictions on aluminum and magnesium were issued July 15. On July 23, Priorities Regulation No. 23 was issued to grant permission to engage in the production of postwar experimental models if they do not divert manpower or facilities from war work.

Scheduled for issuance on July 29 was an order permitting placing of unrated orders for machine tools to be needed for postwar construction. The fourth of the series, an order setting up procedures by which individual manufacturers having available facilities and manpower could get the green light from regional WPB offices, was scheduled for issuance August 15. It is this latter order that is the "enabling act" of the entire program, and Washington is watching with interest to see whether the scheduled date is followed. The military had opposed the announcement of the Nelson program until the war situation is clearer, but a compromise permitted the announcement of three steps — the fourth to come on August 15th if no military setbacks occur.

Oil Rationing Reapportioned

Responsibilities in the administration of the civilian fuel oil program have been reapportioned as follows by Amendment 17 to Revised Ration Order 11:

OPA will continue to have exclusive jurisdiction over the issuance of rations. In addition, OPA will process requests for reinstallations of heating equipment to use fuel oil in residences of less than four family capacity and applications for fuel oil for space heating in other structures using less than 10,000 gallons of fuel oil per heating year. OPA will also have sole jurisdiction over the use of fuel oil burning space heaters.

The Petroleum Administration for War will continue to make final determination regarding installations of new oil burning equipment in any structure. PAW will process requests for authority to reconvert equipment to use fuel oil in buildings housing four families or more and in other buildings where consumption of fuel oil is 10,000 gallons or more per year. All applications for use of fuel oil in new and reinstalled oil burning facilities for agricultural, commercial and industrical processing will be handled by PAW. Appeals for the use of fuel oil in new and reinstalled oil burning facilities will be granted only if the applicant establishes that the use of a solid fuel would entail an exceptional and unreasonable hardship.

Plumbing Order Revised

Limitation Order L-79, governing distribution of plumbing and heating equipment has been revised, effective June 25. Among important provisions the revised order specifies that a seller may deliver to a consumer equipment using gas as a fuel if the installation will increase potential demand for gas, unless the utility company first states by letter that it is authorized to provide the necessary gas. Numerous items have been added to the list restricted by the order, and new instructions for filing applications to purchase are provided.

UNIFORM

When a Tube-Turn welding fitting, be it an elbow, a tee, a return, or whatever type, is ready for shipment, it is *ready for good, long, hard service!* Every fitting must undergo rigid checks and inspections to insure uniformity of dimensions, of wall thickness at all points, of interior surface smoothness.

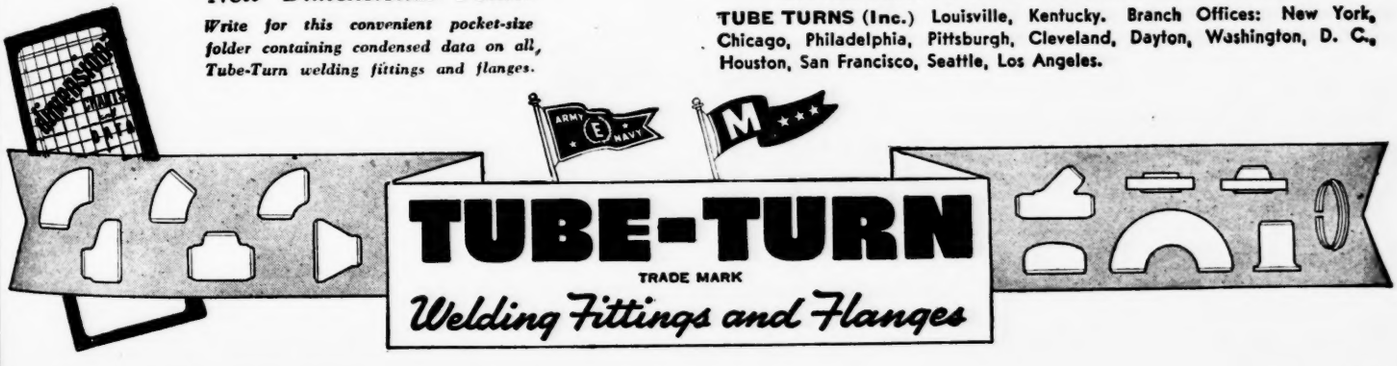
Tube Turns' exclusive manufacturing methods, plus constant vigilance in laboratory and plant inspection of materials and finished products, guarantee welding fittings that are *uniformly* sound, dependable and in accordance with all ASA., ASTM and other applicable standards. Write for Catalog 111.

New Dimensional Folder

Write for this convenient pocket-size folder containing condensed data on all, Tube-Turn welding fittings and flanges.

SELECTED TUBE TURNS DISTRIBUTORS IN EVERY PRINCIPAL CITY ARE READY TO SERVE YOU WITH COMPLETE STOCKS.

TUBE TURNS (Inc.) Louisville, Kentucky. Branch Offices: New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, San Francisco, Seattle, Los Angeles.



Degree-Days for June, 1944

HEATING AND VENTILATING'S 16th year of publication of monthly degree-day data

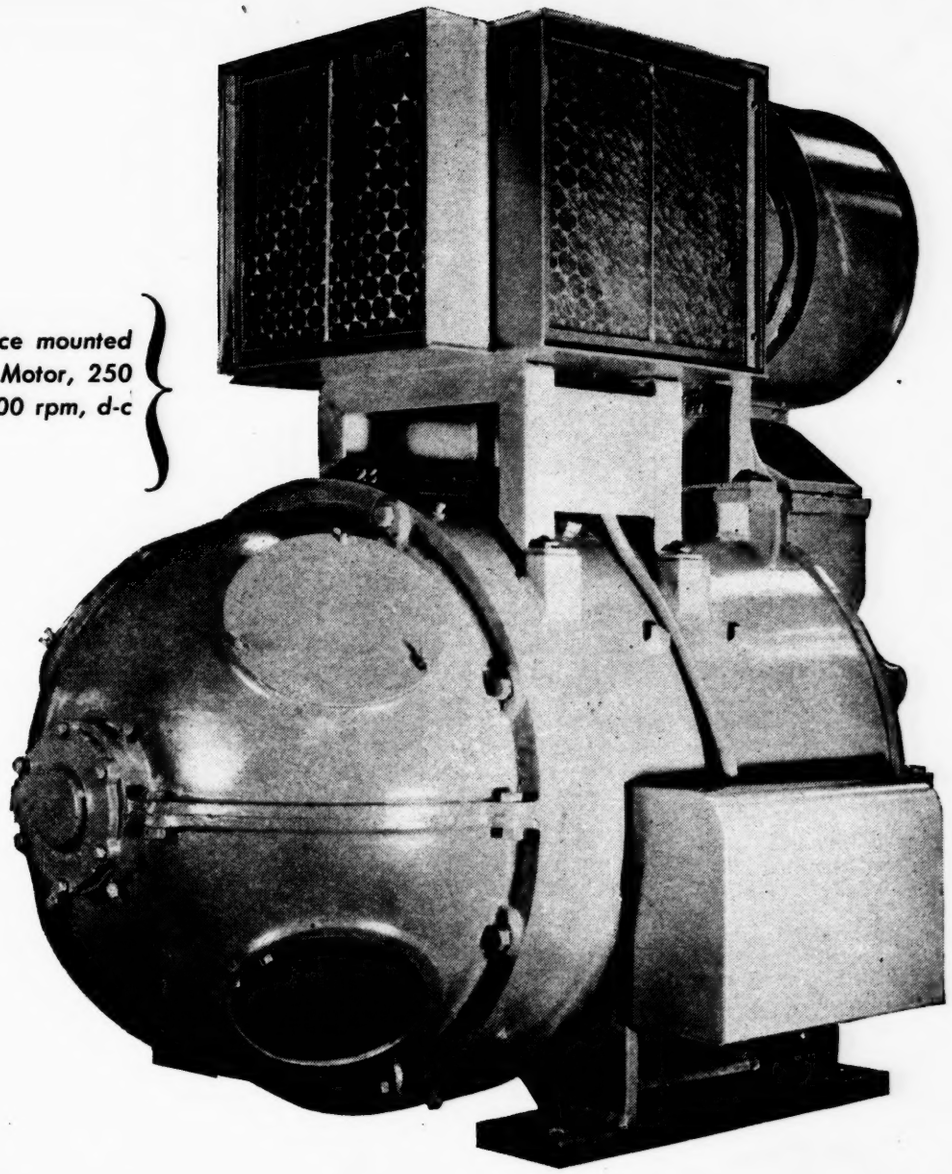
City	Monthly Degree-Days			Cumulative Degree-Days[1]			Year[2]
	Degree-Days, June, 1944	Degree-Days, June, 1943	Degree-Days, June, Normal	Season, 9/1/43-6/30/44	Season, 9/1/42-6/30/43	Season, Normal, 9/1-6/30	Normal, 9/1-6/30
Abilene, Texas	0	0	0	2530	2338	2061	2061
Albany, New York	52	20	0	7174	7363	6580	6580
Albuquerque, New Mexico	3	0	0	4863	3657	4298	4298
Alpena, Michigan	142	107	138	7959	8349	8265	8299*
Anaconda, Montana	381	362	251	8110	8414	8261	8357**
Asheville, North Carolina	0	0	0	4214	4151	4232	4232
Atlanta, Georgia	0	0	0	2939	2875	2890	2890
Atlantic City New Jersey	20	5	0	4974	4872	5176	5176
Augusta, Georgia	0	0	0	2271	2179	2161	2161
Baker, Oregon	263	325	213	6940	7166	7163	7163
Baltimore, Maryland	6	1	0	4451	4410	4533	4533
Billings, Montana	204	178	60	6570	7393	7119	7119
Binghamton, New York	60	25	0	6985	6859	6808	6808
Birmingham, Alabama	0	0	0	2916	2478	2352	2352
Bismarck, North Dakota	117	133	45	8136	9492	9192	9192
Block Island, Rhode Island	85	63	99	5852	6047	5788	5788
Boise, Idaho	167	137	0	6002	5794	5552	5552
Boston, Massachusetts	76	18	0	6062	6174	6045	6045
Bozeman, Montana	333	316	230	7971	8374	8425	8521**
Buffalo, New York	58	69	12	6962	7344	6822	6822
Burlington, Vermont	89	62	3	8130	8270	7514	7514
Butte, Montana	342	340	236	8662	9030	8162	8272**
Cairo, Illinois	1	0	0	3962	3880	3909	3909
Canton, New York	86	54	0	8141	8462	8020	8020
Charles City, Iowa	57	65	0	7388	8211	7588	7588
Charleston, South Carolina	0	0	0	1874	1911	1769	1769
Charlotte, North Carolina	0	0	0	3125	3079	3120	3120
Chattanooga, Tennessee	0	0	0	3587	3266	3118	3118
Cheyenne, Wyoming	186	188	126	7531	7192	7466	7466
Chicago, Illinois	43	45	0	6424	6894	5957	5957
Cincinnati, Ohio	10	5	0	4937	5107	4684	4684
Cleveland, Ohio	24	24	0	6010	6113	6155	6155
Columbia, Missouri	14	0	0	5234	5057	4922	4922
Columbia, South Carolina	0	0	0	2474	2379	2364	2364
Columbus, Ohio	10	8	0	5367	5525	5398	5398
Concord, New Hampshire	109	61	54	7733	7858	7353	7353
Concordia, Kansas	15	22	0	5672	5567	5315	5315
Dallas, Texas	0	0	0	2436	2321	2256	2256
Davenport, Iowa	20	26	0	6205	6648	6289	6289
Dayton, Ohio	12	9	0	5783	5585	5264	5264
Denver, Colorado	48	80	0	5842	5362	5874	5874
Des Moines, Iowa	34	36	0	6440	6754	6384	6384
Detroit, Michigan	28	36	0	6589	6826	6490	6490
Devils Lake, North Dakota	147	198	96	9200	10480	9970	9970
Dodge City, Kansas	10	8	0	5551	4947	5035	5035
Dubuque, Iowa	40	36	0	6738	7269	6790	6790
Duluth, Minnesota	237	243	216	9252	9872	9483	9443
Eastport, Maine	322	291	300	8178	8351	8241	8520**
Elkins, West Virginia	41	9	0	5821	5636	5697	5697
El Paso, Texas	0	0	0	2812	2205	2428	2428
Ely, Nevada	352	305	—	8123	6870	—	—
Erie, Pennsylvania	37	42	0	6388	6484	6273	6273
Escanaba, Michigan	153	133	138	8246	8912	8746	8771*
Evansville, Indiana	12	3	—	4788	4780	4244	4244
Forth Smith, Arkansas	0	0	0	3247	3090	3147	3147
Fort Wayne, Indiana	31	21	0	6606	6743	5925	5925
Fort Worth, Texas	0	0	0	2385	2322	2148	2148
Fresno, California	9	6	0	2573	2425	2334	2334
Galveston, Texas	0	0	0	1163	1046	1016	1016
Grand Junction, Colorado	31	50	0	5470	4785	5548	5548
Grand Rapids, Michigan	38	44	0	6611	6917	6535	6535
Green Bay, Wisconsin	59	90	0	7651	8271	7825	7825
Greensboro, North Carolina	0	0	0	4055	3873	3529	3529
Greenville, South Carolina	0	0	0	3168	3125	3380	3380
Harrisburg, Pennsylvania	16	14	0	5503	5442	5375	5375
Hartford, Connecticut	43	22	0	6327	6456	6036	6036
Hatteras, North Carolina	0	0	0	2724	2539	2571	2571
Havre, Montana	171	187	144	7296	8585	8700	8700
Helena, Montana	287	263	171	7989	8715	7834	7898
Houston, Texas	0	0	0	1304	1212	1157	1157
Huron, South Dakota	84	97	0	7807	8507	8004	8004
Indianapolis, Indiana	11	8	0	5394	5784	5298	5298
Kansas City, Missouri	9	2	0	5227	5066	4956	4956
Kewanee, Illinois	12	24	10	6547	7066	6139	6139
Knoxville, Tennessee	1	0	0	3710	3696	3670	3670
La Crosse, Wisconsin	42	65	0	7408	8178	7322	7322
Lander, Wyoming	224	204	135	8597	7704	7947	7947

[1]Cumulative data identical with monthly figures for September only. In subsequent months, cumulative figures will show record for whole heating season to and including month in question.

[2]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with eight exceptions, based on local weather bureau reports. Exceptions are Utica, Lewiston, Kewanee, and Sioux City, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; Norman E. Ross, Bursar, Bates College, Lewiston, Me.; J. M. Hartman, Engineering Department, Kewanee Boiler Corp., Kewanee, Ill., and Alfred R. Wagstaff, Engineer, Sioux City Foundry and Boiler Co., Sioux City, Iowa, respectively. Anaconda, Bozeman, Butte and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table concluded on page 94]



Dust-catching device mounted on Allis-Chalmers Motor, 250 hp 230 v 400/1200 rpm, d-c 75° C. Rise.

Whirlwind without Dust

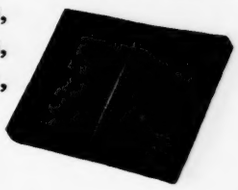
Since forced ventilation of this motor was necessary, it also was imperative that the air circulating through it be cleaned of potentially damaging dust and grit. For this purpose, the Allis-Chalmers Manufacturing Company developed this application of Fiberglas* Dust-Stop* Air Filters.

This installation indicates the versatility of Dust-Stops. There are literally thousands of similar applications, either designed by the equipment manufacturer or devised by the user to solve a particular problem of dust control.

These are standard replaceable-type Dust-Stop Air Filters. They are the same that have been accorded the acceptance of leading heating, ventilating and air conditioning engineers. They are installed in the conditioning systems of homes, industrial plants, commercial buildings, hotels and other institutions from coast to coast.

Maintenance is no problem for the user of Fiberglas Dust-Stop Air Filters. When cells have become loaded to capacity, they are discarded and easily replaced at low cost with new, clean filters readily available from suppliers in every community.

For complete information on Dust-Stops and their many uses, write: *Owens-Corning Fiberglas Corporation, 1912 Nicholas Bldg., Toledo 1, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*



FIBERGLAS* DUSTOP* AIR FILTERS

*T. M. Reg. U. S. Pat. Off.

Degree-Days for June, 1944 (Concluded)

HEATING AND VENTILATING'S 16th year of publication of monthly degree-day data

City	Monthly Degree-Days			Cumulative Degree-Days[1]			Year[2]
	Degree-Days, June, 1944	Degree-Days, June, 1943	Degree-Days, June, Normal	Season, 9/1/43-6/30/44	Season, 9/1/42-6/30/43	Season, Normal, 9/1-6/30	Normal, 9/1-6/30
Lansing, Michigan	54	55	0	7249	7424	7048	7048
Lewiston, Maine	139	57	45	8199	7938	7707	7707
Lincoln, Nebraska	32	40	0	6152	6148	5999	5999
Little Rock, Arkansas	0	0	0	3138	3045	2811	2811
Livingston, Montana	317	250	142	7136	7452	7185	7205
Los Angeles, California	64	42	0	1471	1167	1504	1504
Louisville, Kentucky	3	5	0	4379	4510	4180	4180
Lynchburg, Virginia	1	0	0	3956	3916	3980	3980
Macon, Georgia	0	0	0	2384	2244	2201	2201
Madison, Wisconsin	49	68	0	7293	7886	7429	7429
Marquette, Michigan	187	226	186	8298	8892	8650	8693*
Memphis, Tennessee	0	0	0	3252	3160	2950	2950
Meridian, Mississippi	0	0	0	2385	2179	2160	2160
Milwaukee, Wisconsin	64	104	39	7318	7753	7245	7245
Minneapolis, Minnesota	42	69	0	7659	8619	7850	7850
Modena, Utah	211	160	42	6901	5997	6562	6562
Montgomery, Alabama	0	0	0	2066	1922	1884	1884
Nantucket, Massachusetts	100	65	123	5830	6018	5957	5957
Nashville, Tennessee	1	0	0	3721	3640	3507	3507
New Haven, Connecticut	45	26	0	6156	5974	5895	5895
New Orleans, Louisiana	0	0	0	1234	1205	1024	1024
New York, New York	27	11	0	5391	5319	5347	5347
*Nome, Alaska	960	862	973	12505	12980	13058	14580**
Norfolk, Virginia	0	0	0	3426	3190	3350	3350
North Head, Washington	314	308	309	4628	4864	5002	5452**
North Platte, Nebraska	60	64	0	6468	6160	6366	6366
Oakland, California	158	192	93	3026	2918	2966	3143**
Oklahoma City, Oklahoma	0	0	0	3667	3559	3613	3613
Omaha, Nebraska	35	41	0	6421	6405	6131	6131
Oswego, New York	102	79	63	7236	7353	7088	7088
Parkersburg, West Virginia	18	5	0	5059	4961	4775	4775
Peoria, Illinois	20	25	0	6288	6362	6109	6109
Philadelphia, Pennsylvania	14	7	0	4856	4921	4855	4855
Phoenix, Arizona	0	0	0	1519	1013	1405	1405
Pittsburgh, Pennsylvania	15	6	0	5383	5331	5235	5235
Pocatello, Idaho	239	205	60	7232	6576	6655	6655
Portland, Maine	174	82	81	7901	7868	7218	7218
Portland, Oregon	107	133	90	4090	4183	4469	4469
Providence, Rhode Island	49	15	0	5832	5973	6015	6015
Pueblo, Colorado	29	32	0	6026	5238	5514	5514
Raleigh, North Carolina	0	0	0	3440	3210	3234	3234
Rapid City, South Dakota	173	162	30	7389	7533	7118	7118
Reading, Pennsylvania	16	10	0	5321	5350	5389	5389
Redding, California	41	28	0	2687	2534	2451	2451
Reno, Nevada	241	243	90	6192	5429	5892	5892
Richmond, Virginia	1	0	0	3932	3807	3695	3695
Rochester, New York	66	40	0	7128	7170	6732	6732
Roseburg, Oregon	126	137	114	4291	3930	4428	4428
Roswell, New Mexico	0	0	0	3644	2937	3484	3484
Sacramento, California	46	25	0	2643	2501	2653	2653
St. Joseph, Missouri	21	9	0	5603	5525	5161	5161
St. Louis, Missouri	4	1	0	4721	4677	4585	4585
Salt Lake City, Utah	91	155	0	6217	5654	5555	5555
San Antonio, Texas	0	0	0	1683	1408	1202	1202
San Diego, California	32	32	6	1392	1143	1645	1645
Sandusky, Ohio	20	21	0	6068	6251	6208	6208
San Francisco, California	218	239	195	2672	2685	2876	3264**
Sault Ste. Marie, Michigan	209	227	189	8951	8167	9139	9285**
Savannah, Georgia	0	0	0	1531	1556	1490	1490
Scranton, Pennsylvania	34	21	0	6363	6414	6129	6129
Seattle, Washington	149	160	162	4250	4491	4857	4934**
Sheridan, Wyoming	207	180	120	7392	7490	8008	8008
Shreveport, Louisiana	0	0	0	2243	2106	1938	1938
Sioux City, Iowa	53	68	0	7063	7355	6898	6898
Spokane, Washington	104	201	81	6259	6649	6355	6355
Springfield, Illinois	9	15	0	5467	5537	5373	5373
Springfield, Missouri	11	5	0	4850	4685	4428	4428
Syracuse, New York	65	36	12	7202	7241	6893	6893
Tacoma, Washington	182	180	183	4739	4845	5066	5181**
Terre Haute, Indiana	10	5	0	5228	5287	4872	4872
Toledo, Ohio	34	29	0	6645	6648	6077	6077
Topeka, Kansas	10	2	0	5193	5083	4969	4969
Trenton, New Jersey	17	10	0	5344	5353	4933	4933
Utica, New York	73	18	0	7647	7489	6796	6796
Valentine, Nebraska	113	97	0	7383	7284	7039	7039
Walla Walla, Washington	62	114	0	5055	5049	4808	4808
Washington, D. C.	4	1	0	4460	4377	4626	4626
Wichita, Kansas	2	0	0	4786	4839	4673	4673
Williston, North Dakota	155	199	54	8205	9617	9323	9323
Winnemucca, Nevada	219	197	117	6555	5646	6391	6427**
Yakima, Washington	(a)	97	0	(a)	5787	5599	5599

*Includes August. **Includes July and August. (a) Data not yet available.

[1]Cumulative data identical with monthly figures for September only. In subsequent months, cumulative figures will show record for whole heating season to and including month in question.

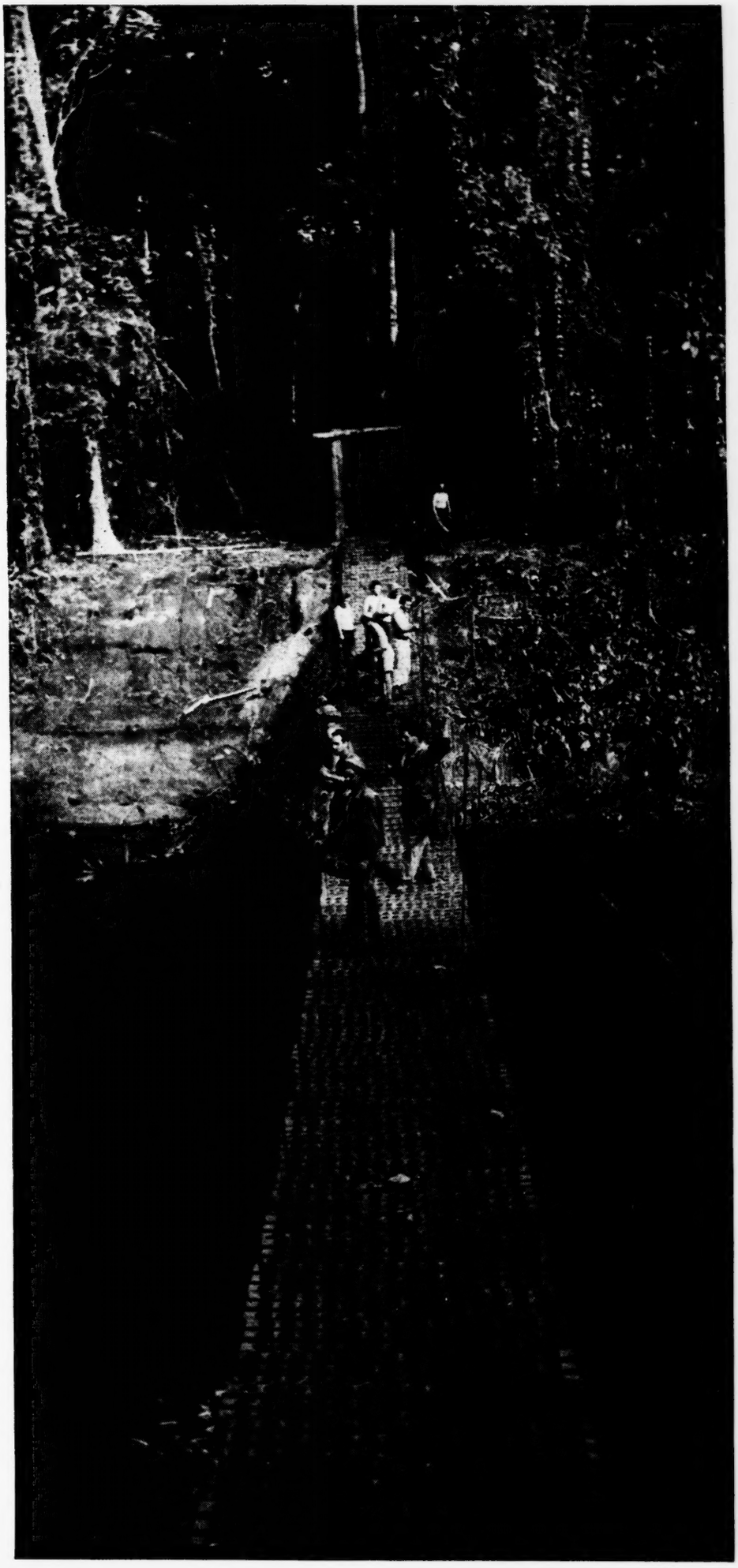
[2]Figures in this column are normal totals for a complete heating season, September to June, incl.

G. I. footbridge

A few dozen airplane landing mats and some wire rope—and the G.I.'s have a fine footbridge across a New Guinea stream. Versatile, these mats. They're interlocking strips of steel, punched full of holes—designed to make an airplane runway in a hurry. But here you see them put to another serviceable use.

It takes 1,500 tons of sheet steel to make just one runway. Bethlehem has been supplying many thousands of tons of sheets for this purpose, and in addition one of its shops is in heavy production of finished landing mats.

Sheet steel for mats, for military containers of many kinds, for bomb fins and shell windshields, for bodies of jeeps, trucks and amphibious vehicles, for bulkheads and similar parts of cargo and fighting vessels; sheets of deep-drawing quality for special uses; galvanized sheets for roofing for Army buildings overseas . . . these are just a few reasons why Bethlehem sheet mills are producing at top speed to supply military and essential home front needs.



Bethlehem Steel Sheets

★ ★ BETHLEHEM STEEL ★ ★

. . . Since the Last Issue

Bell & Gossett Company has appointed **Merritt I. Taylor** as sales representative in Virginia, with headquarters at Richmond. He was previously associated with the American Radiator and Standard Sanitary Corporation.

The firm of **Johnson & Scott** has been added to the list of B & G sales agents. Territory covered will be Western Tennessee, Eastern Arkansas and Northern Mississippi. The agency has opened an office at 918 Dermon Building, Third and Court, Memphis.

Carl Johnson, of this firm, has been engaged in sales, engineering and service work for the past 20 years. His previous activities include engineering work for the Uhrich Supply Company at Kansas City, and sales and installation supervision for the Crandall Packing Company. **Ed E. Scott** served for the past two years as territory representative for the Ohio Injector Company. Prior to this he was connected with Century Engineering Corp., first as New England salesman, and later in charge of that company's Eastern activities.

American Air Filter Company Inc., Louisville, Ky., announces changes in its organization, made necessary by the growth and expansion of the company's business: **W. G. Frank** has been made assistant to the president, **W. M. Reed.** In sales, **H. C. Murphy,** vice-president, has been appointed general sales director; **John Hellstrom,** vice-president, continues as head of the dust control division; **Howard W. Pound** will be in charge of the air filter division, and **Wm. K. Gregory** will direct the special products division.

E. J. Zimmer, Jr., has been appointed assistant to L. B. Keplinger, vice-president and director of sales for **Rheem Manufacturing Company.** Mr. Zimmer will concentrate on the development of sales for post-war products to be made by Rheem which will include household utilities complementary to its current line of automatic water heaters, space heaters, boilers, pressure tanks and other items. A graduate of Cornell University in 1926, Mr. Zimmer has been continuously associated with E. I. du Pont de Nemours & Company since that time. For the past few years he has been with Remington Arms Company, a du Pont subsidiary.

Frank H. Gaylord, vice-president and director, has resigned from **Hoffman Specialty Company,** Indianapolis, as of June 30. In his association with Hoffman for nearly 25 years, in addition to his duties as vice-president and director, Mr. Gaylord had served in an important sales capacity. For many years he made his headquarters in Chicago, directing sales activities on Hoffman products throughout the west, where he is well known to the wholesalers and the trade. After September 1, Mr. Gaylord will be associated with **Economy Pumps, Inc.,** Hamilton, Ohio, as commercial vice-president. He will direct sales and promotion of Economy's new wholesaler division.

Frank H. Gaylord

Randolph A. Klokner has been appointed Chicago district manager of **The Vilter Mfg. Co.,** Milwaukee. Mr. Klokner was formerly sales engineer for Vilter and had been in charge of the Milwaukee and Wisconsin district for 17 years. In his new position, he will direct sales and construction activities in the district served by the Chicago office.

The Whitlock Mfg. Company, Hartford, Conn., has appointed **Norman W. Stirling,** formerly of the M. W. Kellogg Co., New York, as manager of sales. Mr. Stirling was with Kellogg since 1928 where he formed that company's heat transfer division, and at the time he left Kellogg he was sales manager of that division. He has been associated with the War Production Board in the Heat Exchange Advisory Committee.

The Bristol Company has opened a Cleveland branch office in the Engineers' Building, Cleveland 14, to serve Kentucky and Ohio with the exception of the Toledo area. **G. H. Gaites** has been appointed regional sales supervisor of the Cleveland and Pittsburgh territories and will make his headquarters in the new Cleveland branch office. **H. C. Clarke** has been appointed district manager of the Pittsburgh branch office. He goes to his new position from Buffalo where he has been Bristol's resident sales engineer for many years.

H. Dale Cook has joined the controls division of **Perfex Corporation,** Milwaukee, in a sales engineering capacity. Mr. Cook comes to Perfex from the General Controls Company, Glendale, Calif., having served that company's Chicago branch for the past five years. Previously he was associated with the Minneapolis-Honeywell Regulator Co., and with the Michigan Public Service Company.

Harold T. Bodkin has been appointed sales promotion manager of Evanair division, Evans Products Co., Detroit, Mich. Mr. Bodkin's new duties with Evans Products Co. will center upon national sales promotion for the new Evanair line of space heaters, water heaters, floor furnaces and other heating equipment manufactured by the company.

John S. Case has been made factory manager of **Anchor Post Fence Company's** Baltimore plant, succeeding **V. W. Heggie** who resigned last year to enter the Navy as Lieutenant Commander. Before joining Anchor in 1936 as assistant engineer in the heating division, Mr. Case was associated with Robbins and Myers, Inc., Springfield, Ohio. **K. P. Brace,** formerly with Bendix Products Division, Bendix Aviation Corp., and more recently with the Bureau of Aeronautics, U. S. Navy, has joined Anchor as assistant manager, aircraft equipment division.

J. M. Dalla Valle is now engaged in practice as a consulting engineer specializing in problems of technological research, powder metallurgy, atmospheric pollution, industrial dust, and allied subjects, with offices at 60 Wall Tower, New York 5, N. Y. Telephone Whitehall 4-0278.

Pre-peace plans for post-war products was the subject discussed at the Central Sales Division meeting of the **Ilg Electric Ventilating Co.,** at the Edgewater Beach Hotel, Chicago, June 26-28. As one of the features of the meeting, Ilg representatives toured the new Ilg Research Laboratory which is now housed in a special shake-proof, sound-deadened building adjacent to the main plant at 2850 N. Crawford Ave., Chicago.

Professor Hugh E. Keeler of the mechanical engineering department at the University of Michigan, has been appointed a member of the American Standards Association's committee on code for pressure piping. The work of this committee covers the design, manufacture, test, installation, and operation of pressure piping systems. The committee has already completed work on an American Standard Code for Pressure Piping designated B31.1-1942.

SIZING JOB-MADE LIQUID-VAPOR HEAT EXCHANGERS

Under certain conditions it is desirable to use a job-made liquid-vapor heat exchanger with a refrigerating system. The purpose of this and accompanying data sheets is to (1) show how such a job-made exchanger can be sized and (2) determine the net gain in capacity accruing from its use. The data were prepared by William Parkerson, Central Power and Light Co., Victoria, Tex.

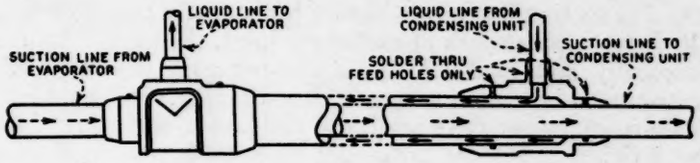

LIQUID LINE TO EVAPORATOR
LIQUID LINE FROM CONDENSING UNIT
SUCTION LINE FROM EVAPORATOR
SOLDER THRU FEED HOLES ONLY
SUCTION LINE TO CONDENSING UNIT
Fig. 1

TABLE 1.—NET ANNULAR AREA BETWEEN TWO CONCENTRIC TYPE L COPPER PIPES

Inside Pipe Diam. Inches, O.D.	Inside Area, Sq. In.	Size of Outside Pipe, Inches, O.D.													
		1/2	5/8	3/4	7/8	1-1/8	1-3/8	1-5/8	2-1/8	2-5/8	3-1/8	3-5/8	4-1/8	5-1/8	6-1/8
		Annular Area, Square Inches													
3/8	.078	.036	.123	.238	.374	.715	1.146	1.669	2.985	4.662	6.702	9.103	11.867	18.556	26.722
1/2	.146		.037	.152	.288	.629	1.060	1.583	2.899	4.576	6.616	9.017	11.781	18.470	26.636
5/8	.233			.041	.177	.518	.949	1.472	2.788	4.465	6.505	8.906	11.670	18.359	26.525
3/4	.348				.042	.383	.814	1.337	2.653	4.330	6.370	8.771	11.535	18.224	26.390
7/8	.484					.224	.655	1.178	2.494	4.171	6.211	8.612	11.376	18.065	26.231
1-1/8	.825						.262	.785	2.101	3.778	5.818	8.219	10.983	17.672	25.838
1-3/8	1.256							.295	1.610	3.287	5.327	7.728	10.492	17.181	25.347
1-5/8	1.779								1.021	2.698	4.738	7.139	9.903	16.592	24.758
2-1/8	3.095									1.225	3.265	5.666	8.430	15.119	23.285
2-5/8	4.772										1.400	3.801	6.565	13.254	21.420
3-1/8	6.812											1.543	4.307	10.996	19.162
3-5/8	9.213												1.657	8.346	16.512
4-1/8	11.977													5.302	13.468
5-1/8	18.666														6.203

It can be shown that considerations of heat transfer surface, overall cost, and overall size all favor a liquid vapor heat-exchanger with the suction line inside the liquid line, as shown in Fig. 1. This design employs standard tubing and fittings. Since standard tubing comes out from the factory in twenty-foot lengths, heat-exchangers of this design are constructed in twenty-foot sections joined together either in straight line or return bend fashion, depending upon the separation between compressor and evaporator.

Tables 1 and 2 are for selecting the proper size of the outer pipe. The following practical example will illustrate the use of the tables:

Example: Suppose, in a given air conditioning system, it be found necessary to install a 1⅛ in. O.D. liquid line and a 2⅝ in. O.D. suction line. What size tubing will be used for the heat exchanger?

Solution: From Table 2, the inside area of the liquid line may be found to be .825 sq in. Since the suction line is on the inside, the inside tube must be 2⅝ in. as given. The outside tubing must be of such a diameter that the annular area between the inside of the larger tubing and the outside of the smaller tube must be at least .825 sq in. In Table 1 move opposite 2⅝ in. to 1.400 and find that 3⅛ in. O.D. is the smallest outside pipe which satisfies this condition, giving a net annular area of 1.400 sq in.

The length of the exchanger and the net gain in capacity is found as follows:

Example: A 12 ton system with a 2⅛ in. O.D. suction line, operating on a suction temperature of 40F and a condensing temperature of 105F, is to have a job-made liquid-vapor heat exchanger installed. The diameter of the exchanger has been determined as explained before. What length should it be?

Solution: Up to the theoretical maximum limitations on net gain in capacity to be expected, the length depends on the net gain to be attained. Refer to Fig. 2. Locate 12 on the lower scale, move vertically to

TABLE 2.—DATA ON GOVERNMENT TYPE L COPPER TUBING.

Tube Size, O.D., In.	Diameter, Inches		Cross Section Area, Square Inches		Surface, Square Feet per Lineal Foot	
	O.D.	I.D.	Outside	Inside	Outside	Inside
⅜	.375	.315	.110	.078	.098	.082
½	.500	.430	.196	.146	.131	.113
⅝	.625	.545	.307	.233	.164	.143
¾	.750	.666	.442	.348	.196	.174
⅞	.875	.785	.601	.484	.229	.206
1 ⅛	1.125	1.025	.994	.825	.295	.268
1 ⅜	1.375	1.265	1.485	1.256	.360	.331
1 ⅝	1.625	1.505	2.074	1.779	.425	.394
2 ⅛	2.125	1.985	3.547	3.095	.556	.520
2 ⅝	2.625	2.465	5.412	4.772	.687	.645
3 ⅛	3.125	2.945	7.670	6.812	.818	.772
3 ⅝	3.625	3.425	10.320	9.213	.950	.902
4 ⅛	4.125	3.905	13.364	11.977	1.080	1.024
5 ⅛	5.125	4.875	20.629	18.666	1.342	1.278
6 ⅛	6.125	5.845	29.465	26.832	1.604	1.530

Published by Heating and Ventilating, *148 Lafayette St., New York.* 8/44.
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the 2⅛ suction line curve, thence horizontally to 30 ft (assumed length of exchanger line), thence vertically and read 1.53% as the net gain in capacity to be gotten with a 30 ft exchanger. If a 20 ft exchanger were used, the net gain would be 1.19%. If a 50 ft exchanger were used, the increase in capacity would be 1.94%; for a 70 ft exchanger, 2.17%; for a 100 ft exchanger, 2.34%; for a 150 ft exchanger, 2.50% increase.

It is seen that increasing the length yields a diminishing return, and that the length of exchanger depends on the selection, by the designer, of that net gain which he feels is justifiable.

Reference Data 277-278 gives charts similar to Figs. 2 and 3 but for 30F and 50F suction temperatures.

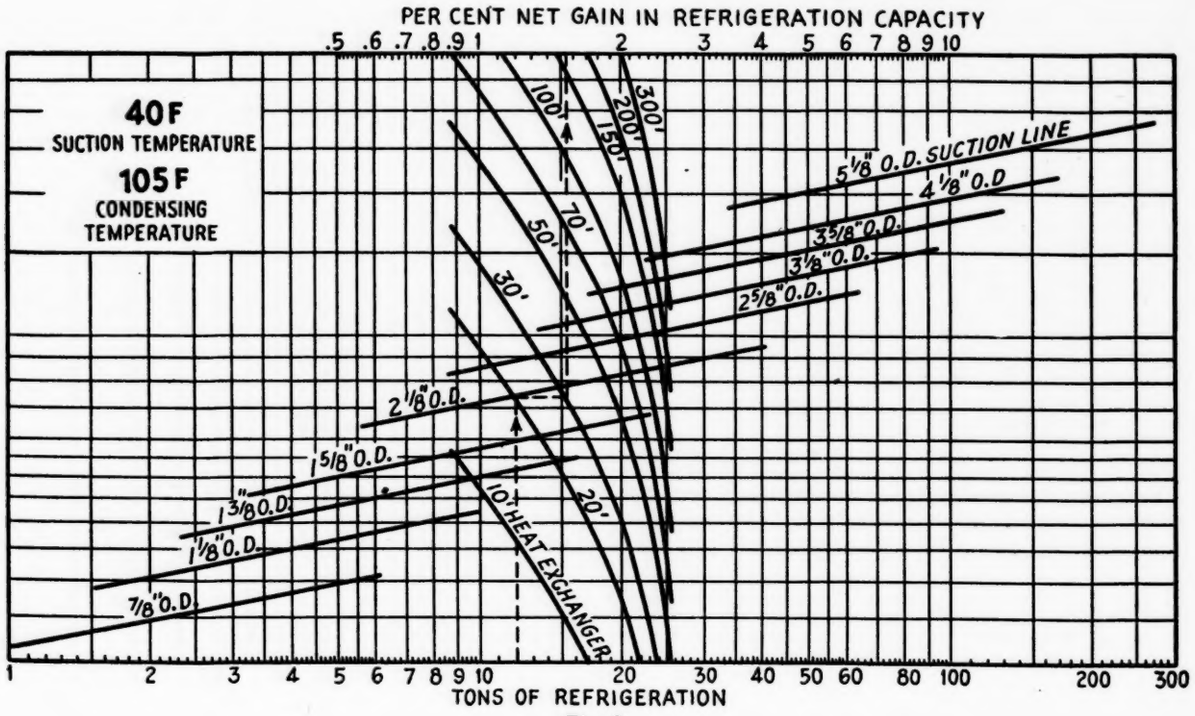

Fig. 2

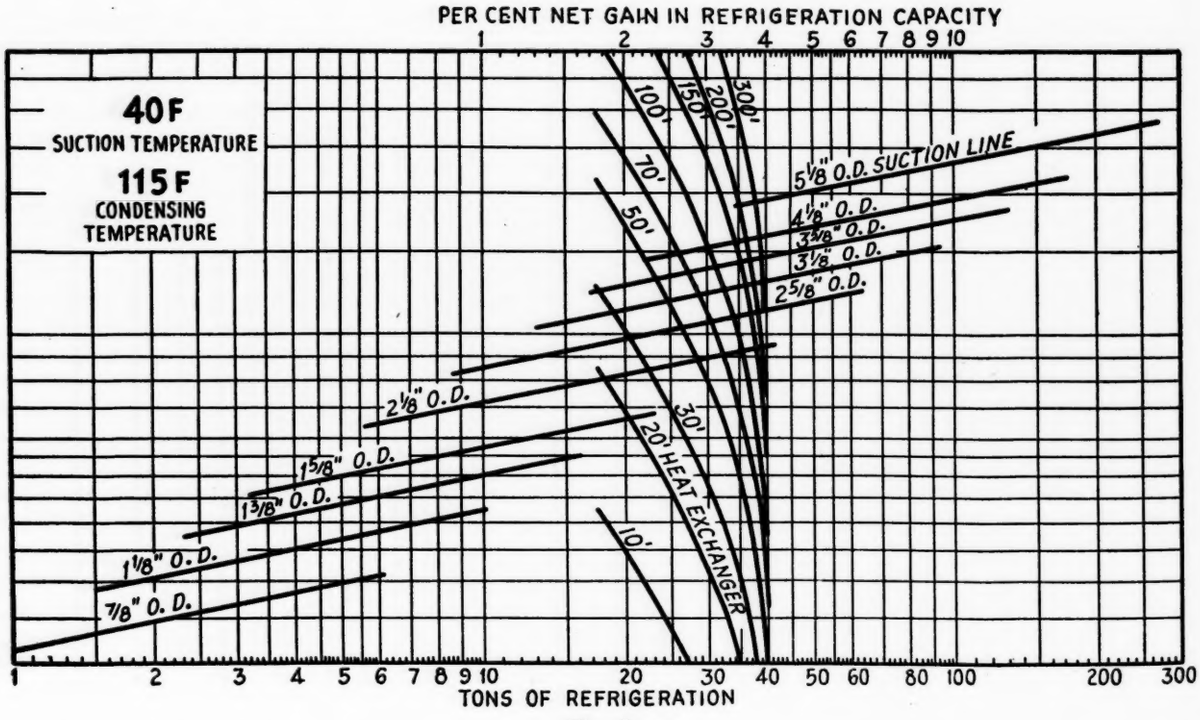

Fig. 3

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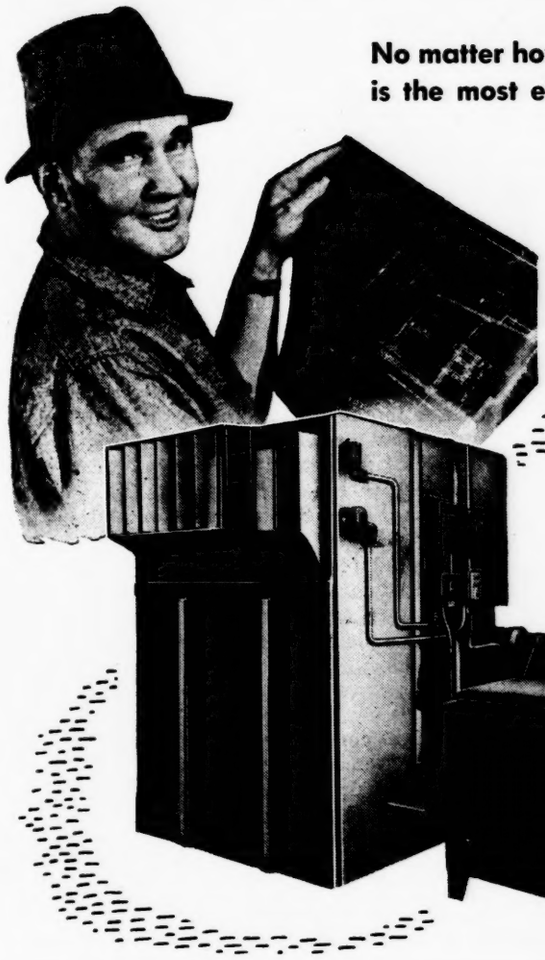

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Raymond L. Clewell

Raymond L. Clewell has been appointed manager of the Heating Division, **Richmond Radiator Co.**, Uniontown, Pa. He was formerly manager of the Gas Division, of the National Radiator Company, and manager of its Post-War Planning Division.

Mr. Clewell will be located at the company's general sales offices, 535 Fifth Ave., New York, N. Y.

The Formica Insulation Co., Cincinnati, is investing $150,000 in expanding and modernizing its power plant. The installations include a new boiler with a new ash disposal system, new stoker and other facilities. A new smoke stack to be constructed will serve as a combination stack for all three of the plant's huge boilers. The company has also announced completion of a special building to house the tube ovens used for production of laminated plastic tubes under conditions of high pressure and heat. The location of the ovens in the separate quarters will reduce the heat in the main factory and improve plant working conditions during the hot summer months.

Orrok & Myers, consulting engineers, New York, since the death of **Geo. A. Orrok**, have reorganized for the continuance of their consulting practice in the field of industrial power and allied problems. The old name Orrok & Myers will be continued with Myers, Fuller and Addington as successors, at the same address, 21 East 40th St., and with expanded engineering facilities. The senior member of the new organization is **David Moffat Myers**, consultant for over thirty years in the field of industrial power and who, for the past thirteen years, was associated with Orrok. **Charles A. Fuller**, authority in heating, ventilating and air conditioning, formerly of the firm of Slocum & Fuller, and an associate of many years standing, now occupies a portion of the office for closer collaboration. **Herbert B. Addington**, specialist in power plant design, has become a member of the firm. **Walter D. Binger** and **Lester C. Hammond**, under the name of Binger & Hammond, engineers, have joint offices with the firm and the organizations are now associated on active jobs involving factory building design and layout, as well as power plant studies and modernization. The enlarged facilities will enable Orrok & Myers to undertake comprehensive problems in the field of industry, including studies and design of both steam and power problems, and heating and air conditioning as well as buildings and structures of all types.

A. Winkler Prins has been appointed manager of the New York district sales territory of **American Machine and Metals, Inc.** Mr. Prins was formerly with Worthington Pump and Machinery Corp., Novo Engine Company, Hubbard & Floyd, Inc., and eastern sales manager for the Wellman Engineering Company. He assumes his duties in the new offices recently moved to the Woolworth Building in New York City. He will supervise the sales and service activities of his company for their Troy laundry machinery, DeBothezat fan, Riehle testing machine and Tolhurst centrifugal divisions.

DeBothezat Fan Division, American Machine and Metals, Inc., has moved its New York district office from 100 Sixth Avenue, New York to the Woolworth Building, 233 Broadway.

Winfred L. Foss has been appointed manager of its Boston district sales territory by **American Machine and Metals, Inc.**, East Moline, Illinois.

West Kentucky Coal Company has added to its staff **George W. Land** as research and combustion engineer. Mr. Land was formerly with Battelle Memorial Institute, Columbus, Ohio. He will contact the Company's dealer and industrial connections and offer his services in connection with combustion and sales problems.

H. Edward Manville, Sr., former chairman of the board of directors of **Johns-Manville Corporation,** died June 27.

Raybestos-Manhattan, Inc., has elected **Harry E. Smith,** general manager of The Manhattan Rubber Mfg. Div., Passaic, N. J., and **Robert B. Davis,** general manager of The Raybestos Div., Stratford, Conn., as vice-presidents of Raybestos-Manhattan, Inc.

●

National Mineral Wool Association has appointed **Arthur Stout** as publicity director. Mr. Stout was formerly with the Copper Recovery Branch and Regional Redistribution offices of the War Production Board in New York.

Modine Mfg. Co., Racine, Wisc., has appointed **Owens Desmond** as sales manager of its heating and air conditioning division. Mr. Desmond succeeds **A. G. Dixon** who is manager of the division and secretary of the company. Mr. Desmond became associated with Modine in 1927 and has been assistant manager of sales since 1931.

W. Russell McMahon has been appointed assistant manager of sales of the division to succeed Mr. Desmond. Mr. McMahon came to the company in 1936.

Manning, Maxwell & Moore, Inc., Bridgeport, Conn., announces that **Harry W. Gray,** until recently assistant to the general sales manager of the Airtemp Division, Chrysler Corp., Dayton, has joined its organization.

L. J. Mueller Furnace Company has appointed **W. E. Haase** as sales promotion manager.

R. D. Bitzer Co., 3109 N. Broad St., Philadelphia, has been appointed to represent **Modine Mfg. Co.** in the Philadelphia territory formerly covered by Wm. S. Kidd. Associated with **Ray Bitzer,** head of the organization, are **Vernon Bitzer, Chas. Lowrey** and **J. Blansfield.**

Insulation

An envelope stuffer featuring a drawing of a typical basement and showing the applications that can be made of asbestos products, all of which are non-critical and readily available. The illustrations justify the caption which reads that every basement is a gold mine for furnace dealers. The folders are available in quantities to jobbers for distribution to furnace dealers from *Grant Wilson, Inc., 4101 W. Taylor St., Chicago 24, Ill.*

Controls

A 12-page, standard size, catalog No. 1 entitled "Sarcotherm Weather Control for Hot Water and Radiant Heating." Includes cut-away drawing, explanation of construction and operation of device, together with typical hook-ups for various types of heating systems. *Sarcotherm Controls Inc., 222 N. Bank Drive, Chicago 24, Ill.*

(Continued on page 100)

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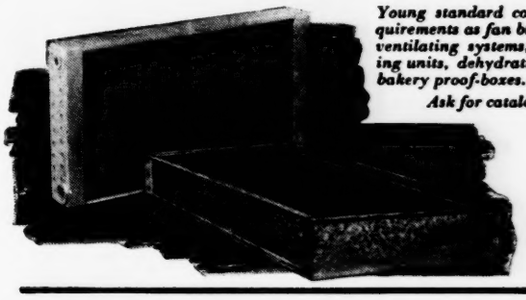

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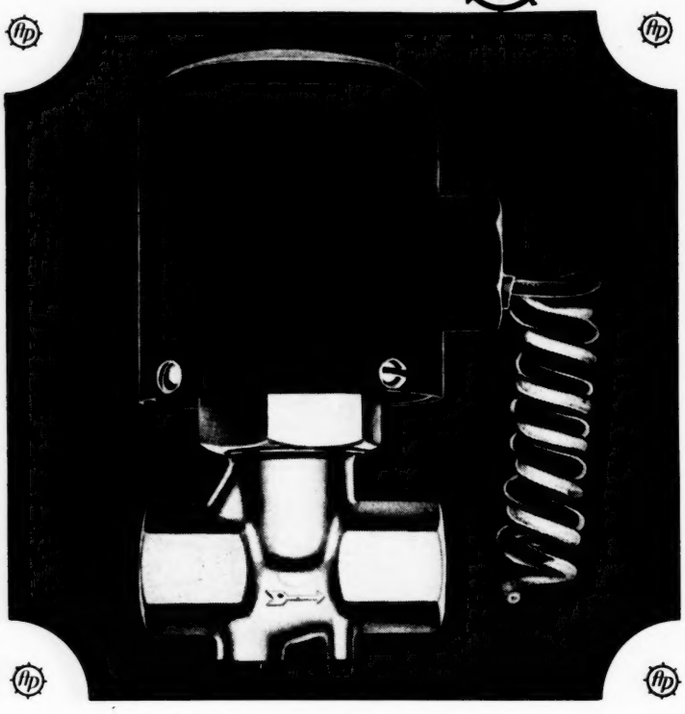

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DEPENDABLE
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(Continued from page 99)

Refrigeration Valves

A condensed catalogue 88-L has been issued to describe the Imperial line of refrigeration and air conditioning valves, fittings, service tools, dehydrators and allied items. *The Imperial Brass Manufacturing Co., 1200 W. Harrison St., Chicago 7, Ill.*

Hydraulic Gauges

A 4-page folder, Bulletin 230-A, describes several types of gauges for use on hydraulic pumps and presses. Construction details are given as well as specifications. *Watson-Stillman Co., Roselle N. J.*

Steel Grating and Stair Treads

Data on open steel grating and stair treads is presented in a 24-page illustrated catalog. Applications are illustrated by installation photographs. Specifications are presented for the various styles of open gratings. *Wm. F. Klemp Co. 6601 S. Melvina Ave., Chicago 38, Ill.*

Zoning

A 58-page, standard size manual devoted to the company's personalized heating control for apartments and containing engineering discussions on this subject plus the detailed layouts and descriptions of the winning designs for the company's prize contest announced last fall on personalized apartment house heating control. The prize layouts included are eight in number and include three two-pipe steam, two 2-pipe hot water, one 1-pipe hot water, and two 2-pipe hot water radiator heating systems. An exceedingly comprehensive engineering section covers applications of automatic control valves and gives detailed information on motorized and pneumatic valves for accomplishing apartment house zoning. *Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.*

Reduction Regulators

A 16-page illustrated catalog, Form 40, describes the design and construction features of single and two-stage reduction regulators used in the welding industry for properly using cylinder gases and flame application processes. *Victor Equipment Co., 844 Folsom St., San Francisco, Cal.*

Blower Wheels

A standard size, 20-page bulletin 24-1 covering Janette blower wheels, profusely illustrated and including descriptive, dimensional and capacitative date of the company's full line of this type product. *Janette Mfg. Co., 556 W. Monroe St., Chicago 6, Ill.*

Protective Coatings

A 12-page pamphlet entitled "New Approaches to Surface Protection," a technical discussion of the advantages ascribed to Preferred White Hot and Preferred Pyro-Chrome, protective coatings which have a high degree of heat reflectance. Booklet includes graphs showing the relative reflectance values of different colors found in refractories and other heat-resisting surfaces. White and green are shown to have the highest heat reflectance properties. A relatively thin coat, penetrating into the material to which applied, is intended to form a pore-deep bond, proving highly resistant to heat, corrosion and oxidation and more enduring than thicker coatings of other heat-resisting materials. Refractories, metals, ceramics and glass are substances on which these coatings have already been found effective, and it is believed that many as yet undiscovered uses will disclose themselves. *Preferred Utilities Mfg. Corp. 1860 Broadway, New York 23, N. Y.*

Switches

A 44-page standard size catalog describing more than twenty of the company's Thermoswitches, including installation drawings and photographs for both temperature and pressure control apparatus. General details of the Thermoswitch graphically explained, featuring a fourteen-inch illustration of a cut-away view. This device has wide application in industrial and commercial use, and may be used throughout the entire range of temperature control work, from sub-zero to 1200F. Various types have been designed for the control of temperatures of solids, gases, and liquids. New adaptations have been added for aircraft and railway use. Catalog includes section on selection and application of Thermoswitches, illustrated with temperature charts and diagrams to show the basic principles involved in temperature regulation. *Fenwal Inc., 200 Pleasant St., Ashland, Mass.*

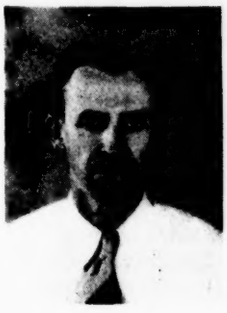
Getting Personal

E. L. Schulz

E. L. Schulz (Based on Experience, page 49), the author of a new series of articles on air conditioning, to run in five consecutive issues, was born in Baltimore, Md., and received his E.E. degree from the Rensselaer Polytechnic Institute, Troy, N. Y., in 1933.

For the next four years he worked for the Consolidated Edison Company, New York City, specializing in gas fired dehydration and dehumidification equipment. During the last seven years he has been with Carrier Corp., Syracuse, N. Y., and has served as application engineer, sales engineer, and research engineer.

Mr. Schulz is the author of a number of technical articles and is a co-author of Chapter 24 of the current A.S.H.V.E. Guide.



W. R. Waugh

It has been a long time since we have had an author as deep-South as **W. R. Waugh** (Refrigeration Aids Dam Construction, page 58).

Born and raised in rural Alabama, he attended schools in Montgomery County. He received his B.S. in Civil Engineering from the Alabama Polytechnic Institute.

Following graduation, he was with the Dixie Construction Co., and was associated with the construction of 3 dams for hydro-electric developments in Alabama and Georgia. Employment was intermittent during the depression years. Since 1934 Mr. Waugh was continuously employed by the TVA in the construction of eight dams. This group includes the Norris, Hiwassee and Fontana, the three largest dams of the TVA. Most of the work was concerned with the study of structural behavior of mass concrete dams. At present he is in charge of concrete cooling operation and field work required for investigation of structural behavior of Fontana Dam.

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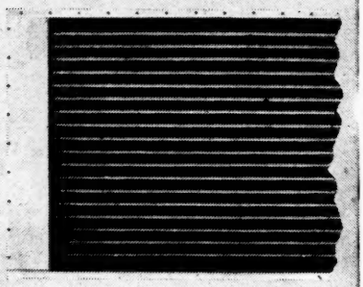
HEATING AND AIR CONDITIONING PRODUCTS

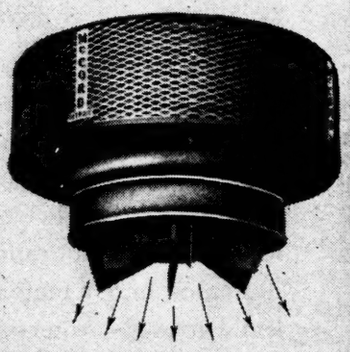
BLAST HEATING COILS
AIR CONDITIONING COILS
ALL TYPES

McCord spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded.



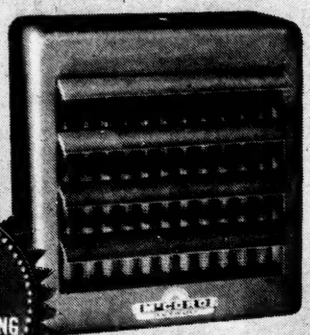
VERTICAL TYPE
UNIT HEATERS

A tried and proven heating unit, modern in design. McCord spiral fin tube construction creates air turbulence without undue restriction, thus increasing heat transfer capacity. Guaranteed for 150 lbs. saturated steam pressure. Nine models.



HORIZONTAL TYPE
UNIT HEATERS

Proven, rugged, modern design. Quiet, guaranteed for use on #150 p.s.i. steam pressure. Heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Ten models.



YOU CAN DEPEND ON McCORD AIR CONDITIONING PRODUCTS

McCord RADIATOR & MFG. CO.
DETROIT II, MICH.

News of the Month

(Concluded from page 85)

Climate Duplicated for Cotton Mills

WASHINGTON—The pilot plant wing at the Southern Regional Research Laboratory of the U. S. Department of Agriculture is well filled with machinery and is working on a variety of problems connected with getting the results of scientific research out of the laboratory stage and into shape for practical adoption by industry. D. F. J. Lynch of the Bureau of Agricultural and Industrial Chemistry, director of the laboratory, recently outlined some of the problems that were then in the pilot plant stage of development.

"Inside the pilot-plant wing," he said, "there has been erected a cotton mill 95 feet long by 65 feet wide which occupies several rooms on three floors. This experimental mill is completely air-conditioned with an individual air-conditioning unit for each floor so that temperature and humidity can be varied in one room without affecting any other section of the mill. With this equipment we are able to make experimental runs under conditions representing the climate prevailing in particular localities throughout the cotton-manufacturing belt. This experimental mill includes standard textile machinery for all steps in the manufacture of cotton fabrics.

In the spinning and weaving of cotton the weather conditions of temperature and humidity are so important that many of the early cotton mills were grouped in centers where the weather was favorable. This is still an important item, but in recent years air-conditioning has made it possible to locate mills in generally unfavorable climates, and to get better results than are possible in any mills that are not air conditioned.

Coal Supply to be Tight

WASHINGTON—Supplies of coal, fuel oil, and wood, will remain tight during 1944 and 1945, according to information released by the OWI.

For the coal year which begins on April 1, there is an estimated deficit of 21,000,000 tons consisting of 16,000,000 tons of bituminous and 5,000,000 tons of anthracite. Those who burn anthracite for space heating will only obtain about ⅞ of their normal supply, while domestic users of Southern Appalachian coals in certain southern states will receive about 0.9 of their normal supply. However, no form of coupon rationing will be followed.

Even though the coal situation is not good, the Solid Fuels Administration pointed out that the coal deficit had been cut from about 30,000,000 tons during the first quarter of the coal year. The SFA estimated the coal requirements for 1944 as 626,000,000 tons of bituminous coal and 65,000,000 tons of anthracite. Bituminous production for the present coal year may total 610,000,000; anthracite production is not expected to exceed last year's figures.

Edgar H. Bristol

FOXBORO, MASS.—Edgar Hiel Bristol, 73, president and one of the founders of the Foxboro Company, died July 24 at his summer home, Falmouth Heights. He was a leader in the perfection of automatic control by industrial instruments and had more than forty patents to his credit.

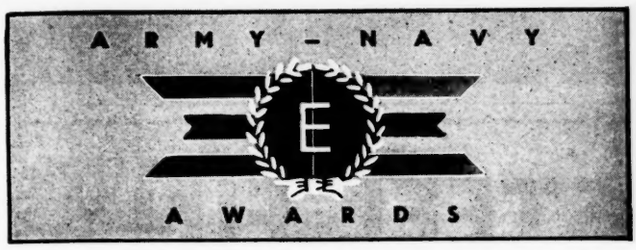
W. S. Michael

MENDOTA, ILL.—W. S. Michael, general sales manager of Conco Corporation, Heating Division of H. D. Conkey & Company, died July 6. He was 51.

Mr. Michael joined Conco in 1936. At that time he established Conkey's heating division. Prior to his joining the Conco organization, he was associated with Gregsby-Grunou Company in Detroit and with the Round Oak Company of Dowagiac, Mich. He was also with A. V. Sampsel, now of Spring Valley, Ilinois.

INDUSTRIAL DEGREE DAYS
May and June, 1944

City	Number of Industrial Degree Days			
	55F Base May	55F Base June	45F Base May	45F Base June
Baltimore	0	0	0	0
Buffalo	27	4	0	0
Chicago	53	3	8	0
Cleveland	19	0	0	0
Detroit	37	0	0	0
Indianapolis	26	0	1	0
New York	4	0	0	0
Philadelphia	0	0	0	0
Pittsburgh	10	0	0	0
St. Louis	35	0	6	0



Sarco Company, Inc., New York 17, N. Y.
(Second star)
The Foxboro Company, Foxboro, Mass.
(Second star)
Tube Turns, Inc., Louisville, Ky.
(Extra stars for "E" pennant and "M" burgee)
Builders Iron Foundry (Builders-Providence, Inc.), Providence 1, R. I.
(Third star)
Homestead Valve Manufacturing Co., Coraopolis, Pa.
(Third star for "M" pennant)
Cochrane Corporation, 17th St. and Allegheny Ave., Philadelphia 32, Pa.
(Addition of star)

COMING EVENTS

AUGUST 22-25—National Power Show, Jefferson Hotel, St. Louis, Mo. A. F. Thompson, Director of Exhibits, 176 W. Adams St., Chicago.

SEPTEMBER 21-22—Open forum of the Indoor Climate Institute, Book-Cadillac Hotel, Detroit, Mich. Executive Secretary, Arthur E. Schanuel, Penobscot Building, Detroit.

OCTOBER 2-5—Fall meeting of the American Society of Mechanical Engineers to be held at the Netherlands-Plaza Hotel, Cincinnati, Ohio. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 15-19—Third National Chemical Exposition will be held at the Chicago Coliseum, Chicago, Ill. Sponsored by Chicago Section of the American Chemical Society. Headquarters for the show at 330 So. Wells Street, Chicago 6, Ill.

NOVEMBER 27-DECEMBER 1—Annual meeting of the American Society of Mechanical Engineers to be held at the Hotel Pennsylvania, New York City. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 27-DECEMBER 2—16th National Exposition of Power and Mechanical Engineering, to be held at Madison Square Garden, New York City. Charles F. Roth, president of the International Exposition Company, New York, is manager of the Exposition.

DECEMBER 10-13—Annual meeting of the American Society of Refrigerating Engineers to be held at the Hotel Pennsylvania, New York City. Secretary, David L. Fiske, 50 W. 40th St., New York 18, N. Y.

What are You doing about Stokers?

FREEMAN STOKERS

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Available for Prompt Delivery

Today . . . with the urgency of the government's fuel conservation program . . . there is an unusually large and profitable stoker market among handfired plants burning 25 tons or more of coal per year. *Tomorrow* . . . there will be an even larger and more profitable stoker market when domestic models are again available. Take advantage of this present and future money-making opportunity by joining forces with Freeman now. Freeman . . . a pioneer of the stoker industry and one of the leaders in national sales volume . . . offers you a complete line, a success-proved promotion program, and the security of a dependable, financially strong manufacturer who will always be in the stoker business to serve you!

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